

Aviation Week

and Space Technology

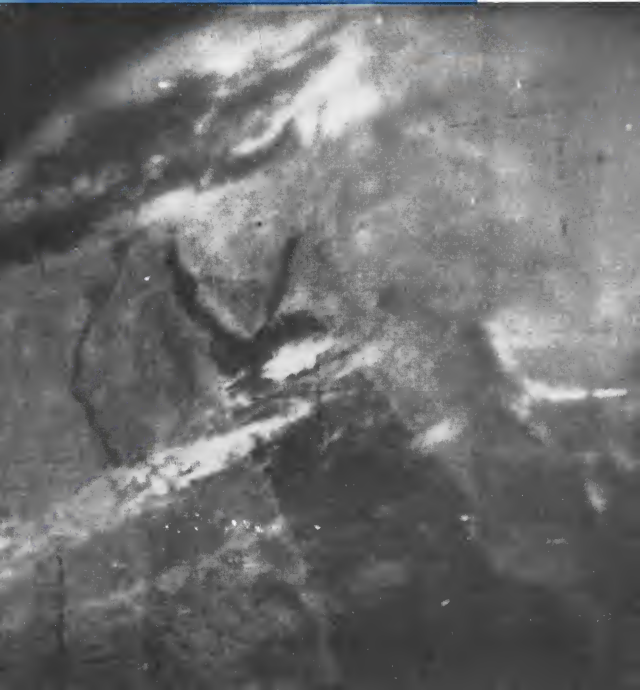
May 16, 1960

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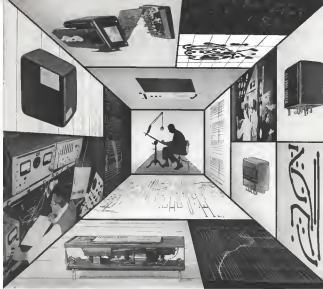


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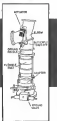
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AVIATION CALENDAR

- (Continued from page 5)
- June 22-24-1962 Conference on Space and Electronic Measurements, NBS, Boulder Laboratories, Boulder, Colo. Co-sponsors: Institute of Radio Engineers, Professional Group on Instrumentation Radio Research Laboratory, National Bureau of Standards, American Institute of Electrical Engineers, Instrumentation Division.
 - June 22-26: 15th Annual Meeting, Institute of Navigation, U. S. Air Force Academy, Colorado Springs, Colo.
 - June 26-July 1: 1st Annual Meeting and Apparatus Exhibit, American Society for Testing Materials, Chalfont-Hedden Hall, Adelaide City, N. J.
 - June 27-28: Fourth National Convention on Military Electronics, Institute of Radio Engineers, Sheraton-Park Hotel, Washington, D. C.
 - June 29-July 2: National Summer Meeting, Institute of the Aeronautical Sciences, Ambassador Hotel, Los Angeles, Calif.
 - July 1-4: Fourth Annual Joint Wiring National Communications Conference, closed circuit, video, audio, text, West Wycombe, Ind.
 - July 13-14: Liquid Rocket and Propellant Conference, American Rocket Society, Ohio State Building, Ohio State University, Columbus, Ohio.
 - July 23-25: Denver Aerial Symposium on Computers and Data Processing, Denver Research Institute, University of Denver, Stanley Hotel, Estes Park, Colo.
 - Aug. 13-14: Fourth Global Communications Symposium, Statler Hilton Hotel, Washington, D. C. Sponsors: Institute of Radio Engineers, U. S. Army Signal Corps.
 - Aug. 13-14: Western National Meeting, National Astronautical Society (George Hotel), Seattle, Wash.
 - Aug. 14-15: 1962 Pacific Council Meeting, National Institute of Electrical Engineers, 20 Carter Hotel, San Diego, Calif.
 - Aug. 15-20: 41st Annual Congress, International Astronautical Federation, Royal Institute of Technology, Stockholm.
 - Aug. 22-24: Western Electronic Show & Convention, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.
 - Aug. 25-Sept. 5: 1962 National Air Safety Symposium, Dayton, Ohio, Ohio State University, National Aeronautics Assn.
 - Sept. 6-11: 1962 Pendragon Flight Display and Exhibition, Society of British Aircraft Constructors, Pendragon, Eng. Sept. 22-26: 16th Annual General Meeting, IAF, Capotaormina, (Ireland).
 - Sept. 22-26: Second International Congress, International Council of the Aeronautical Sciences, Zurich, Switzerland.
 - Sept. 24-26: National Meeting, National Van of State Aviators Club, West Hotel, Jackson, Wyo.
 - Sept. 25-14: 1962 Annual Meeting, Annual Future Chemical Assn., Sheraton-Park Hotel, Washington, D. C.
 - Sept. 22-25: National Convention and Air Space Symposium, Air Force Assn., Club Laddington and Brooks Hall, San Francisco, Calif.
 - Sept. 27-30: Power Section Conference, American Rocket Society, Maxwell Hall, New York, N. Y. Co-sponsors: USAF, U. S. Army, U. S. Navy, National Aeronautics and Space Administration, Atomic Energy Commission.



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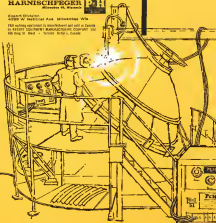
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A report from Hercules Powder Company on the performance of ALTAIR

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The Altair is the most reliable and most advanced solid propellant rocket engine for space research available to the free world.

Chemical Propulsion Division, Hercules Powder Company developed and produced the double-base solid propellant, high altitude rocket Altair at the Navy Bureau of Weapons-owned, Hercules-operated Allegany Ballistics Laboratory. The engine case is Spirafloy® continuous filament-wound, resin-bonded glass fiber made by Hercules' Young Development Division; it provides the highest strength-to-weight ratio of known materials, thus enabling a greater weight propellant or "more push per pound" in the finished rocket motor. The significance of this performance is obvious to all who are vitally concerned with the missile-rocket program.

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Pioneer V
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Upper photo: Hi-Loks make the entire lower rib joint in one beam. Lower photo: Hi-Lok's offset tool on 8145s Air Blow units, Hi-Loks on both flanges. The Hi-Lok tool-man is solid and eliminates the progressive grinding in the structure normally associated with the installation of wedge type fasteners using pneumatic hammers.



HI-LOK OFFSET TOOLING CIRCUMVENTS STRUCTURAL FLANGES

The change to high strength Hi-Lok Fasteners and Hi-Lok tooling on the Northrop T-38 Talon supersonic jet trainer, overcomes acute accessibility problems caused by wedge flanges on structural ribs and beams in the thin, single panel wing. The switch to Hi-Loks from wedge type fasteners resulted in a substantial savings in installation manhours.

More than a 50% tool cost savings alone was realized at Northrop when wedge hammer tooling, with its single purpose power units, squarer yokes and other special cooling was replaced with simple Hi-Lok offset tooling adapted to standard, multi-purpose air driver motors.

Installation rates up to 45 Hi-Loks per minute are achievable using automatic drivers where the structure is open and where speed of installation is essential.

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Hi-Lok's offset angled adapters fitted to an irregularly shaped flange—offsets a 2-in. diameter assembly job as the loading gear—offset adapter fits in a clearance about 1/2 in. Additionally, the change to Hi-Loks reduced the required force application rate from 30% to practically nil.



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JET PODS BY ROHR



Profilizer and load evaluation B52H engine pod and pylon load by Rohr to show above. Lower photo shows external connections and drive mechanism between turbofan engine that will power the air right jet Boeing B52H aircraft numbers 52-01 and the turbine currently used on the B-52C jets.



FOR SAC'S NEWEST "SUNDAY PUNCH"

Within a year, the Boeing Airplane Company in Wichita will begin rolling out the newest version of its distinguished Stratofortress, the B-52H. Rohr, an active participant in the B-52 program from its beginning nearly a decade ago, is producing jet pods for the "H".

The mighty B-52 has earned its role as an enduring workhorse of the Strategic Air Command. No longer considered just a bomber, it has been dubbed a "lauching pad" in the sky by its makers.

With the Rohr built turbo pods of the B-52H will be eight Pratt & Whitney turbofan engines, providing about 50 per cent more takeoff thrust, 25 per cent more cruising power, and 20 per cent greater cruise power than its predecessor.

With a range of well over 8,000 miles and an arsenal of devastating missiles the "H" will be an awesome deterrent to aggression, and a lasting reason for peace.

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The Univac computer is used to simulate and design the mechanical design of new systems. This concept of mechanized design, which may be described as the use of new computers to build rather, administer, manage, building and utilize a design of reliability can be used on any mechanically operated.



A simulation is shown in making design prototype by the Univac computer. This computer in mechanized design on early facilities the production of reliable mechanical data processing systems.



A specialized design is used of mechanized design in the SIGANT program, produced by Remington Rand Univac, for the U.S. Navy Atomic Submarine. Making of the program and systems, which is designed to reduce the size of the computer units, is made by increasing the reliability through the use of integrated and control circuitry.

From the REMINGTON RAND UNIVAC

Military Division

Mechanized Design Dramatically Speeds Development and Increases the Reliability of New Data Processing Systems

Remington Rand Univac was the first to apply the concept of mechanized design to computer development. By using the Univac Scientific Computer, the design of a projected system can be fully simulated and provided thus avoiding the expensive, time-consuming process of prototype building.

This important technique has already made indispensable contributions to the development of such systems as the Univac LARC and Albatra and the Univac Advanced Navy Computer. Mechanized design has significantly aided Univac scientists and engineers in measuring the critical limits of reliability, even under the most demanding environmental conditions.

The Military Division's tradition of excellence is firmly established by a distinguished series of defense systems. Mechanized design is another example of the outstanding capabilities which Remington Rand Univac can bring to bear on the development and production of complex computer equipment for military applications.

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AERO PRODUCTS, INC.

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CLEMCO AERO PRODUCTS' Tab and Flap Damper are used on the CORSAIR F105 and F4U

TAB DAMPERS

The Clemco Aero Products Tab Damper is used on the F105 and F4U aircraft to dampen the flap mechanism at low speeds to prevent flutter.

The important requirements of this application are low weight, low cost, and a temperature range of -50°F to +100°F.

The Clemco Aero Products design meets these requirements with a highly hydrolytic damper with a well-tuned aerodynamic and thermal compensation.

Maximum stress (flexure) is 1.5 inch lbs. at -40°F

Damping constant up to 500 inch lbs./rad./second

Torsion - 40°

Lowest limit 100 inch lbs.

Flow mass efficiency 90,000 inch lbs./rad

Flow 500, 10, 50,000

Weight 1/27 lb.

Operating frequency 1" diameter orifice oscillates for 1/1000 to 1/100

The damper has undergone more than a million cycles of operation at 100% amplitude, at a rate of 100 CPS and extensive thermal cycling with no evidence of deterioration.

The characteristic of low static friction low inertia high dynamic modulus and linear damping characteristic in this type design compensation allows maximum application where mechanically limited motion damping is demanded.

Designs to meet your specific applications will be prepared on request.

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- Flap - 2 Flap Open - 2 Tab Closed
- Flap - 2 Flap Open - 2 Tab Closed

FLUTTER DAMPERS

The Clemco Aero Products Flap Flap Damper is used on the control surfaces of the aircraft to dampen flap flutter as well as to steady high performance airfoils.

The primary advantage is low static compensation, low static friction and minimum weight, plus rigidity per pound of structural weight.

Static compensation is achieved by hinge tab installation. Low static friction is a necessary for proper operation of a control system and is achieved by having the surfaces of the damper seals using a constant size of approximately one-half inch.

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The Clemco Aero Products Flap Flap Damper is a self-regulated temperature compensated, rotary hydraulic damper with integral shock load bearing spring and a novel fluid level indicator.

These units are now in production and have been fully qualified.

Size	Operating Temperature	Damping Constant	Static Friction	Dynamic Modulus	Weight
1/2"	-50 to +100°F	100,000	100	100,000	1/27
3/8"	-50 to +100°F	200,000	200	200,000	1/27
1/4"	-50 to +100°F	300,000	300	300,000	1/27
3/16"	-50 to +100°F	400,000	400	400,000	1/27
1/8"	-50 to +100°F	500,000	500	500,000	1/27

All maximum damping constants are at +100°F and are in accordance if desired at lower temperatures. The length of all units is approximately 1" and the static friction approximately 1/2 inch lbs.

Dampers with internal resistors other than the above can be supplied with an additional cost.

Although these units were developed for flap applications, they are equally effective for use on other aircraft surfaces.

YOUR NEXT NEED CAN BE MET, EITHER IN STRUCTURAL WEIGHT WITH CLEMCO AERO PRODUCTS ROCKET ACTUATORS AND TAB AND FLUTTER DAMPERS.

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Lockheed U-2 Over Sverdlovsk:

The whole truth of Francis Gary Powers' 1,600th penetration of the Soviet Union on a Lockheed U-2 on a Central Intelligence Agency mission of photo and electronic reconnaissance has not yet been told. It may never emerge from the writer of official lies passing from Moscow and Washington.

Nevertheless, there are some points that have already emerged from this adventure that are worth examining. Let us start with the fabrications that have been laid around from the mission of the Supreme Soviet by Nikita Khrushchev because they reveal much about his fears and problems over the current state of the world.

Mr. Khrushchev's main blarney has been his statement that the U-2 was hit by a Red Army anti-aircraft missile at an altitude of 65,000 ft near Sverdlovsk after it had penetrated the air defenses of the Soviet Union for some 1,600 mi. This lie was necessary because the citizens of the USSR could understandably grow uneasy over the advanced ability of the U-2 and other specialized aircraft to penetrate Soviet airspace continuously with impunity. The spectacle of Soviet air defense systems falling for the first time to man is trying to wrap their protection must provide a chilling counterpoint for Soviet citizens to the belittling blarneying of their leader over the aggressive strength of his military power.

The fact is, and Mr. Khrushchev undoubtedly knows it, that Powers' U-2 had an engine flammout at the altitude that it and other U-2 aircraft crashed safely beyond the reach of the Soviet air defense system. The fastest forced Powers to descend below 40,000 ft, where the denser atmosphere made an attempt to restart his engine futile. Either Powers failed to restart his engine or his plane was damaged at that relatively low altitude by the Red Army missile men to whom Mr. Khrushchev awarded medals.

Another obvious lie was used to bolster that originally false claim for the Soviet air defense system. A picture of some badly battered scrap from an Aeroflot Tu-104 crash near Sverdlovsk last February was officially shown to the Soviets labeled as the U-2 wreckage to convey an impression of terrible damage wrought by the anti-aircraft missile. When this tale was exposed by Lockheed's U-2 designer, C. K. "Kelly" Johnson, the mission of the genuine U-2 was finally proclaimed for an exhibition in Moscow's Gorky Park.

Further contradictions of the missile hit story at 65,000 ft was the Soviets' own claim that they recovered most of the U-2 photo and electronic reconnaissance equipment in good condition, were able to examine the cockpit flight instrument in detail and to retrieve much information from the cockpit intact.

Mr. Khrushchev has good reason to worry about the ability of the U-2 and other aircraft to skim over his bag air defense system. For it must cover as well as land studies to Soviet citizens, but a steady diet of propaganda on the superiority of Soviet military might, to bow the admissions from Mr. Khrushchev and Andrei Gromyko that these U-2 flights have been going on incessantly for at least four years. The Soviet citizens must wonder, if

this is true, how much evidence they see place as the missions they receive from Mr. Khrushchev that named bombers are obsolete and cannot penetrate the Soviet air defense system. Even if his claim of a missile hit at Sverdlovsk was true, how does Mr. Khrushchev explain a 1,600-mi penetration from the Pakistan border to the Ural?

It is obvious that Mr. Khrushchev does not really believe his own claims about the deficiency of named bomber penetrations into the USSR because he has been making a specific reference of his air defense system for the past several years. This includes an improved surface-to-air, and ground control intercept radar, passive detection systems, new interceptors and a transmission program of new supersonic missile combinations aerial fuel, mid-air and industrial uses. If Mr. Khrushchev really believed the Strategic Air Command B-57, B-52 and B-58 fleet of nuclear bombers were as ineffective as he publicly blarney, he would hardly waste the vast resources that he has used in still putting into his air defense system.

Not is Mr. Khrushchev telling the truth when he announces that the Soviets have switched completely from bombers to ballistic missiles and that they are longer in producing or developing or increasing bombers because they are obsolete for modern warfare. The USSR is still producing long range jet bombers, although at far from maximum possible rates. It is developing new supersonic bombers and a nuclear-powered bomber and it is increasing its current operational jet bomber fleet at an accelerated rate in long distance Arctic missions. Mr. Khrushchev would like us to believe his lies as the future of the bomber in the Soviet arsenal. This belief would encourage the West, already started, toward cutting back its own air defense system.

Mr. Khrushchev is also ignoring some pertinent facts when he stresses the "provocative" nature of the U-2 flights. The Soviet espionage system in this country has been exposed in many aspects of its hidden head of operations. The second from the atomic secret watching of Klem Fuchs to the very Jewishly espionage secret operated by the Soviet Col. Abel has offered ample provocation for anything that country does to make of it.

The Soviets are fighting the reconnaissance war with every method at their disposal all around the periphery of the Iron Curtain, cutting transatlantic cables off Newfoundland, tapping for Cuban anti-airborne warfare stations flying for some coast of American Island, monitoring the Atlantic Manila Range communications, shadowing Palau submarines and conducting electronic reconnaissance on our frontiers by tracks, submarines and aircraft. The Soviets do not require deep penetrations of the United States for photo reconnaissance because of the availability of this information from public sources and their espionage system. Their prime need is for electronic intelligence and this they are getting with every means at their disposal.

A Study in Fabrication

When we turn to the record of our own government agencies involved in the U-2 adventure the record of deliberate fabrication is equally bad. The series of interagency battles began in a quiet feeling over what might happen as a real emergency with survival or defeat hanging on the speed and accuracy of the official reaction.

First, there are the very tower members of the old NACA now with NASA who had their hard-won reputation for scientific integrity shredded overnight by the exposure of their role in swallowing dupes of the Central Intelligence Agency. They use an excuse to stall scientists at an office of a few research programs for high altitude weather and gust loading research from the military. This budget of military activity to NACA was traditional, since NACA had no budget of its own for this purpose. NACA wrote the test program request itself, specifically got back data from missions conducted according to its specifications and apparently never did much analytical research into the geographic locations of the U-2s or the relation of the agency from any contact with their personnel. NACA, and later NASA, dutifully published three technical reports in a few years on the work and worked happily in the traditional role of the pure pilot in a region who was never told what was going on upstairs.

This coupling of CIA (which Washington was not now strong enough for Coughlin at the Alt) with NASA as an interagency espionage venture will badly damage, if not altogether destroy, the fine tradition NASA was enjoying for international cooperation in the scientific exploration of space. NASA can hardly blame foreign nations already admitted in this program for ignoring as to how much of a trading status, launching site or payload communications is demanded for CIA reasons. Nor can they be blamed for publicly declaring to take a chance with an agency that apparently doesn't know all it should about its own activities.

This damage to NASA's scientific integrity may prove for little in the national calculations of CIA super-theists, but it will do irreparable harm in the international scientific community where that country has many of its staunchest friends.

Second in the spectacle of the State Department being a complete loss routine somewhat from the fact is that "there was no deliberate attempt to violate the Soviet airspace and there never has been," to a noisy admission that their flight have been such flights but that they "were not authorized by Washington," to a final complete admission that the U-2 penetration was an act as integral part of U. S. national policy. What the State Department can command as a credibility factor in future sales as a U. S. spokesman will be interesting to see.

The official U. S. policy as finally stated by President

Eisenhower some 10 days after Powers' U-2 hit the Siberian earth also carries some future forebodings.

It officially condemns the United States in a continuous and deliberate policy of violating the Soviet airspace and finally makes exposure an integral part of U. S. policy. Although virtually every American citizen can see the need for continuous surveillance of the Soviet Union by whatever effective methods are available and will readily support these efforts, it is quite another matter to publicly announce that espionage and violation of another country's territory have become an official policy.

This policy, which is reproduced in the history of nations, leaves our allies in an intolerable position and forces the Soviets to carry this matter much further than they may have originally intended. It appears to be another one of those last, poorly thought out, unapproved policies made at a quick fix with not much thought for future consequences or other implications.

Third, of course, comes the Central Intelligence Agency, in the incident stripped of all its protective secrecy, and standing nakedly exposed in an incredibly unbecomingly performance compromised from inadequate training, faulty command and rather transparent cover operations. Apparently, all that was adequately provided in this operation was the \$30,000-a-year salary for the pilot. Whatever reasons impelled Francis Powers to decline to carry out the traditional self-destruction orders of the espionage agent approached and handed by the enemy may never be known. Suffice to say his overwhelming survival was not in the best traditions of either USAF, the agency that originally trained him, or CIA, the agency that kept him without training him properly in its specialized requirements.

The need for a organizational or some other "watchdog" operation over CIA was never more apparent.

Finally the most important aspect of the U-2 episode in the dissemination of first that to most Americans on the simple silent fact that we are in fact fighting a war against the forces of communism. It is a far different war than we have ever fought before and it is being fought with weapons that we are not accustomed to using. The bombing, assets and resources our various government agencies have deployed as the U-2 episode show clearly that we are not yet organized for this type of conflict nor do we yet really understand its scope and strategy.

Although too few Americans realize it, we are already deep into this struggle to determine whether the Soviet system or our own will prevail. If we hope to preserve the basic elements of this civilization we should, we must deliberate our national resources thoroughly in this task and organize our national resources and policies more effectively to achieve this goal.

—Robert Hutz



THERE'S A TAKEOFF IN THAT RUBBER BAG

Douglas Aircraft engineers wanted to store pressurized air for emergency jet engine starting on the DC-8 transport model. Rather than using valuable space inside the aircraft, they came up with the novel idea of storing air in the cavity in each main landing gear strut.

B.F. Goodrich fabricated leadproof strut liners which hold the air, and protect the metal from moisture. Special rubber provides the ultimate in long life. In service, each bag is charged to 3000 pounds per square inch, enough to provide energy for two engine starts.

Fabricating rubber to meet unusual requirements fits right in with B.F. Goodrich experience...from strut liners and fuel tanks to vapor barriers and De-Icers. Whenever you have a problem that rubber know-how can solve, check with BFG. Write B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Dept. AW-3C, Akron, Ohio.

B.F. Goodrich aviation products



WHO'S WHERE

In the Front Office

William L. Rogers, vice president Aero-plant, Aero-Design Corp., Aero Club
William T. Smith, general manager of Services, Inc., Hawthorne, Calif.
Vic Stauder, a company vice president who continues in manager of the Los Angeles Division

William T. Starbuck, president and chief executive officer Inco Aerospace Inc., Longwood, Calif.
E. Paul Miller, Jr., president and a director, Lockheed, Burbank, N.Y.

G. Bruce Miller, president F. & M. Inc. & Co., Inc., Indianapolis, Ind., including Joseph E. Cox, vice chairman of the board

Neil Detrick, a director, Transco Enterprises Corp., El Segundo, Calif. Via the web is chairman and director of Transco Pacific Corp.

Herman Finkler, a director, Denver and Morgan, Inc., Winston N.Y. Mr. Finkler is president of General Transco Corp.

Dr. Franklin E. Lowman, president, Advanced Technology Corp., Santa Barbara, Calif., a subsidiary of Electronic Concepts Inc.

A. M. Rankins, vice president, Hill and Kautzman, Inc., San Diego, Calif.
Dr. Nathan, vice president of Douglas Aircraft Co. before retiring, will continue in special consultant for Douglas

Zeno Smith, vice president of Good Control Reel Co., Eastern Region, Wash. state, D.C.

E. Paul Hoffman, a vice president, The Dow Aircraft Corp., division manager of Transco Division & Association Group, Inc., Tex.

Robert H. Gerber, executive vice president, Consolidated Fibreboarders Corp., Pasadena, Calif., a subsidiary of Bell & Howell Co.

John E. Knapp, executive vice president, Intimate Engineering Corp., Anaheim, Calif.

Harold A. Cahill, one of the nation's leading authorities on development of all weather operations for transport aircraft, has joined the aviation consultant firm of E. Dixon Spurr Associates, Manhattan, N.Y.

Robert O. Sullivan, vice president and general manager Electronic and Inco systems Division, Telford-Lane-Bland Inc. Corp., Wilmette, Ill.

George C. Stewart, vice president for sales systems and contracts, Air Logistics Corp., Pasadena, Calif.

Ann E. Sanders, executive vice president, USC Technical Center, Fontana, Calif.

R. Harvey Whipple, executive vice president, manufacturing, Bellco Aircraft Company Inc., New York, N.Y.

Capt. Paul J. Rice (USN ret.) has been appointed Technical Services Director of the Institute of the Aeronautical Sciences, New York, N.Y.

P. G. Smith, executive vice president, and **Donald E. Baker**, vice president sales, Royal Jet Division of Royal Industries, Inc., Alhambra, Calif.

(Continued on page 149)

INDUSTRY OBSERVER

► Landing complex at the Pacific Marine Range, Calif., for the Avco Fire's M-100 and Saturn-rocketed reconnaissance satellite system are almost complete. One is now being checked out with a "walkdown" test vehicle in place, the other is approximately 90% complete. The two Atlas-type pads are designed to take either Saturn or Atlas intercontinentally.

► Launch of Navy Advanced Research Projects Agency's Target IIIA probably will be postponed by at least six months. ARPA Army Signal Corps defense receiver communication satellite Courier IA is now scheduled to be launched on July 15. Data for Target IIIA is now set for Nov. 1.

► Areas of engineering specialization assigned to the seven Marine space pilots when they first began training will determine which air vehicles which flight is capable of being flown by the Marines. Flight training program and related flight program will be devoted into various areas at special checkout of guidance and control system, recovery system, navigation, life support system, etc.

► Adoption of the European metric system for parts used in U.S. launch payloads is being faster than expected to be completed by the end of 1964. The metric system for both U.S. and USSR payloads is being coordinated by National Aeronautics and Space Administration's Jet Propulsion Laboratory.

► At least one major defense contractor has agreed to a new Air Force program for during the cost of cost-estimated research program which previously could be charged off fully against defense production (AW Feb. 22, p. 28). Under agreement reached to date, Air Force will allow contractors to charge off 30 to 75% of research program costs, with companies recovering 60 to 80% of the total. Sharing ratio varies with individual companies and their progress. General Electric, International Business Machines Corp., North American Aviation and Republic Aviation were among the first to sign.

► Construction of a sizeable 500-ft-dia. under-iceberg powered by a multi-engine float transmitter for astronomical studies of the outer solar has been proposed to several governmental agencies by Stanford University and Stanford Research Institute. Under contract has been awarded over into astronomical float; it does not deal again with cargo, carried by, this and planet. However, it is considered non-nuclear, rather than conventional, larger. Larger spherical balloons to date is 600 ft. diameter balloon being built at Sugar Grove, W. Va., by the Naval Research Laboratory.

► Competition for G-10 ground checkout equipment by the Douglas Aircraft Co. and Lockheed Martin's equipment for the new Heavy Duty production aircraft (AW Mar. 8, p. 28) has been won by Boeing. Equipment will be built at Boeing's Everett, N.J., facility. Initial order is for two development units and 14 production sets.

► Safety parachute tested out by Strategic Air Command to ensure that no one was ever bigger a hydrogen-walshed float (ICM) includes a parachute for placing two float balloons in opposite ends of the overall float. Balloons must be pulled outwards. Another of the number of safety factors built into the parachute system that the walshed will not be activated unless it experiences gravity loads no greater than have been calculated in the static testing, providing a possible safety detection is friendly action.

► First Northrop T-38 Talon supersonic trainer is scheduled to be delivered to the USAF Air Training Command's Randolph AFB, Tex., in January, with the first operational planes going to the USAF's 44th TFW, FWD. Production plus currently call for a total of 744 T-38s, with 65 leased in Fiscal 1960, 144 in Fiscal 1961.

► Egle AFB, Fla., has been chosen by USAF as the first test for development version of the Douglas Skybolt air-launched ballistic missile.

LIBRASCOPE MISSILE COMPUTERS

To the moon and back and wherever missiles fly, Librascope computers deliver ready answers for in-flight control, guidance, optimum trajectories, impact prediction, data reduction and analysis. Throughout flight... Librascope missile computers are uninterrupted by environmental extremes... and they will automatically and continuously check their own built-in accuracy. The compact size, minimum weight and performance of Librascope missile computers have earned them important roles in our conquest of space. For information on how Librascope advanced computer capabilities particular needs, write to Librascope, 808 Western Ave., Librascope, A Division of General Precision, Inc. For engineering career opportunities, contact Glen Selzer,



can answer your Glendale, Calif. information on EmploymentMfg.



computers that pace man's expanding mind



Washington Roundup

NASA Boosted Plans

National Aeronautics and Space Administration is assuring Congress that it will not duplicate the military services' work at facilities in space medicine. Dr. Clark Rensel, chief of NASA's Office of Life Sciences, says he plans to hold a special headquarters staff of 10-15 highly qualified professionals this year.

Rensel says NASA will stick to basic research and won't duplicate the services' applied research in the biotechnology field. Space agency plans a small life sciences research center to permit the headquarters staff to keep current on research.

NASA plans to hold meetings at 10-15 centers in space business within the next month as to its demands improvement of base-line experiments in space. Congress will try to find better a way to use goods already available at space stations. It also will plan biological studies possible at biological experiments.

Human factors expert Alfred M. Myers will join NASA this month as assistant director for bio-supporting in the Office of Life Sciences. Myers currently is chief, separator and safety research, for Douglas Aircraft Co.

Dr. Cornelius A. Tobias will join the space agency life sciences staff about Sept. 1. Dr. Tobias has studied the effects of radiation on humans. He will be on leave from the University of Colorado.

Public Relations Policy

National public relations policy on key space items is being set by the White House, not NASA, with Reg. Gen. Andrew J. Goodpaster, staff secretary, playing a key role. Latest Goodpaster idea is to bypass a top official message from President Eisenhower off the Project Echo communications relay satellite. Original tape intended peaceful use of space, but plans have changed since the U-2 accident.

USAF's Operations Committee, originally scheduled last month at Maxwell AFB, will now be held May 18-20 at Andrews AFB. Purpose of the meeting is to give top Air Force commanders a chance to talk a hard look at weapon system development and production progress over the next decade (NAF Age 4 p. 25). Committee is to determine the kind of use of the USAF weapon system in or that period.

Soviet air force commander Chief Air Marshal K. A. Vershinin and some top aides are scheduled to see key USAF installations in a seven country tour of the U. S. Soviet group will attend the Arnold II since Dr. Shaw at Andrews AFB, then move on a tour that will include Tactical Air Command headquarters at Langley AFB, Air Force Missile Joint Center at Cape Canaveral and Strategic Air Command base at Ft. Worth, Tex.

USAF Missile Concern

Air Force is concerned over its lack of ballistic missile assets, test and launch capability. USAF has relied on contractors to handle these functions in research and development launches. Contractors are still used as an important supplement to test and training activities at operational bases.

Major Air Force effort to increase its capabilities may come in the Dyna-Soar program. USAF may try to increase the available test and launch rates in the sounding program.

Special House group is evaluating the secret nuclear propulsion program. Sub-committee of the House Appropriations Committee was established after that group authorized ANP program when it approved the \$75 million Fiscal 1961 request for USAF's share in the program. Members of the special subcommittee are: behind closed hearings on ANP as Rep. Claude Minner (D-Tex.), Harry R. Shogren (D-Calif.), Louis C. Robert (D-Mich.) Ben F. Jensen (R-Iowa) and John R. Flynn (R-N.Y.).

Russian apparently recovered the capsule ejected from Discoverer II last week which headed its Spikobegon. Recovering capsule and parachute were seen and located by three Navarogers. An intensive search of the landing area produced no capsule but these were signs that a had been found and carried to a nearby Russian colony.

Descending capsule should have been easy to see from the Soviet colony, but the Russians denied any knowledge of it when asked. Discoverer II was supposed to eject the capsule north of Koshka, Alaska, for recovery area Hovda. A small subcommittee and progressing now find the astronaut parachute.

Wrapup

Senate Defense Appropriations Subcommittee is scheduled to complete hearings on the defense budget this week, then move into closed sessions to make its final decision. Senate version of the budget is expected by June 15. General Accounting Office report on Air Force management of its ballistic missile program is scheduled to go to Congress this week. Airforce subcommittee of the Senate Commerce Committee will begin hearings this week on proposed authority for the CAB to limit the type and extent of service in air carrier certificates. —Washington Staff



Extremely clean wing fairings, jettisonable engines and other design features are shown in these photographs of a Lockheed U-2 with National Aeronautics and Space Administration markings taken at Edwards AFB, Calif., five days after a U-2 was lost near Stockholm, Russia. Slight drop of the wings indicates their light construction.

Extreme Cleaness, Manufacturing Care Mark U-2

Unusual leading gear on the Lockheed U-2 provides considerable savings in structural weight, an important factor for high-altitude aircraft. Small wheels on flexible struts are built flush on ground to save weight and drag off at takeoff. Near the end of the leading ground rail, the pilot normally turns onto the gear and back over on one wing tip dial.



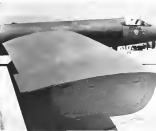
Self-identification marks on the U-2 shown at Edwards are the NASA's letters in a small shape on the tail and a trail number (left). Manufacturing excellence in the U-2 is evidenced on its tail area which has both riveting and consistently so accurate of alignment also punch perforations in the surface over the aircraft. The manufacturing tolerances held on the after sections of the U-2 are better than those on the nose of many operational high-speed aircraft. The aerodynamically balanced rudder elevator mechanism with almost no gap at the hinge again show extreme manufacturing care. The fuselage U-2's were originally constructed in the Experimental Department of the



Colburn Division of Lockheed Aircraft Corp. Note view of the U-2 (right) shows double track main gear and its brake system. Large open area are provided on bottom and both sides of the U-2 main structure to permit the mounting of a variety of sensors and other reconnaissance equipment. Units can be mounted in the rear of the aircraft. Main engine air intake air bags for a single engine aircraft and its nacelle for high-altitude operation. The inlet lips are fairly sharp because of the compressibility problem the aircraft experiences near its maximum altitude. Assembly air scoop on the right side of the fuselage is located back under the wing.



Steeking on the fairings under the wing shows types of tool to be used in the aircraft, gives canopy opening and access instructions and includes the conventional system, not warning eye. Ball-shaped body on strut at the top of the windblast houses a receiver wave for the pilot. Details of the slats and



rib interlaminar and the wing tip dial design are shown at right. The top dial also serves as a port for the wing and reduces the strength of the wing tip vortex and supports the air flow of the wing when it is operating at high lift coefficients as it would be during cruise at high altitude.

Soviets Exploit U-2, Boast of Strength



REAL U-2 WRECKAGE was finally destroyed later by Soviets in Moscow Gorki Park, exhibit after other failed wreckage pictures had been exposed by Lockheed's Soviet and Russian Embassy. Wreckage shows some portion of U-2 wing panel. Search team to have recovered most of the U-2 wreckage; equipment lost and description of cockpit instruments indicate they may have succeeded that plane already destroyed, with other portions on three other class of cockpit lost at 61,000 ft. Post & Whitney (P) says from U-2 exhibited in Moscow showed evidence of impact damage. Tail section was intact except for missing outer skin. U-2 wreckage was painted light black and no insignia was visible on wings, fuselage or tail.



PARTIAL U-2 WRECKAGE is shown in this photo originally released by the Soviets labeled as the wreckage of the U-2 as it was shot down near Sverdlovsk. Wreckage is actually the section of an Aeroflot Tu-104 jet transport that crashed near Sverdlovsk last February killing an official Chinese delegation to Moscow. G. L. Kelly Johnson, Lockheed designer of the U-2, mentioned the strongest members showing in this photo and said they bore no resemblance to the lightweight U-2 structure and were probably of a heavier type aircraft. Aeroflot Tu-104 crash near Sverdlovsk was one of few publicly announced in USSR because of long foreigner detentions abroad. Filled U-2 wreckage was apparently released to create suspicion of heavy damage from Soviet air-attack inside where genuine U-2 wreckage displayed later in Moscow showed actual damage sustained along aircraft belly section. This hints a Soviet landing. Khrushchev revealed results to find Army missile crew who allegedly fired the rocket that supposedly hit the U-2. None other aircraft wreckage has been observed in the Sverdlovsk area since last summer.

Moscow-Soviet Union last week exploited the May 14 shooting of a Lockheed U-2 reconnaissance plane well inside Russian with boasts of its own defensive strength and warnings to U-2 and its allies that further flights might be met by "even deadlier weapons."

At a press conference held shortly after U-2's destruction, State Chairman, Herter and the U-2's plans to reinforce such flights, Soviet Foreign Minister Andrei Gromyko warned:

"Clear again, the violation of the sovereignty and integrity of foreign frontiers, spying and subversion, as pronounced at the U-2 official policy. "We shall meet, as the Soviet people have always met aggression, and the cost which dare to make a mistake into our borders will be rendered to mathematics."

Gromyko warned that those "who had been on that territory for several months our frontiers should know that in the event of a repetition of such provocations, the Soviet Union will be able to render these bases harmless."

Earlier, a Radio Moscow broadcast broadcast in the U-2's hour that, "If these American flights over our territory do not cease, the Soviet Union will be compelled to take more drastic action and the security of the United States will be hardly benefited."

The flare over the U-2 crash—and the debate over the actual facts behind it—were Sverdlovsk, 1,400 mi inside the Soviet border, was dramatically touched off by Premier Nikita Khrushchev four days after the crash.

In a speech before the Supreme Soviet, in which he failed to mention that U-2 pilot Francis Powers had been captured alive, Khrushchev said:

"The day, May 14, an American plane flew over our frontier and entered its flight into the territory of the Soviet land. A report on this aggressive act was immediately given to the government by the Ministry of Defense."

The government has noted this. Since he realizes what he cannot say against what involving into a foreign territory, it is not easy to say that he will attempt to find any solutions. Therefore, the plane must be shot down."

"This task was fulfilled, and the plane was shot down."

Khrushchev said that, upon being told of the invasion, he personally ordered that the U-2 be shot down.

He said he had given the upgrade crop and May 7 also U-2's (update) had issued a statement that a U-2 firing a high-altitude warhead weapon in the vicinity of Lake Van near the southern border of Turkey had been seen by Soviet authorities.

The Soviet Press, after a wait of two days, then attacked in a speech high lighted by a statement that U-2 pilot Francis Powers was Soviet hero, Khrushchev said the Supreme Soviet:

"The day fulfilled he had no illusion we had his major operation field (on U-2's attack had speculated). He was flying along an assigned course, and consequently, his flight's safety, switching on and off equipment over passenger targets for showing intelligence data on the Soviet Union's military and industrial establishments and the means until the very moment he planned flight into the country's airspace was not short."

He told the Supreme Soviet that the U-2 was hit at an altitude of approximately 57,000 ft by a "rocket" and bursted that, "If there is no higher, we will also be there."

A "complete examination of experts" which examined the wreckage of the U-2, Khrushchev said, had established that the American plane was, in general, prepared reconnaissance aircraft with the means of course "the entire territory of the Soviet Union" from Pakistan to Norway. He added:

"British aerial reconnaissance plane carried other reconnaissance equipment for getting radio intercepts, identifying the location and frequencies of operation stations and other special radio intercepting equipment."

Khrushchev also described patterns 2 to 2 ft in size and showed among other things:

- "Articles and places on it"
- "Aerial bases and points"
- "Industrial enterprises"
- "Signs of a number of sea ground radio stations"

Khrushchev said, were recorded on one of the tapes.

During Washington's version of the flight "the pilot was killed" and that he had found the "trash" of U-2 wreckage.

The plane's last was at Washington, in Alaska, Turkey, Khrushchev said. It was situated in a certain intelligence and headed by Col. William Sheffield, numbered 3010. The 101st unit, Khrushchev charged, was using the National Aeronautics and Space Administration, in which the aircraft was at based, as a cover, while probing Soviet radar installations.

Khrushchev quoted Powers as saying that on May 1 he left Penikese, Point Barrow, New York the Red Sea and then headed toward Sverdlovsk, where his plane was downed.

He also quoted Powers as saying that he has told Soviet leaders "with instructions to fly along a course indicated on his map over the Red Sea, Sverdlovsk and other points, and near Archangel and Murmansk before landing at Bodo Airfield in Norway." He said Powers had told Soviet authorities:

Khrushchev Scores Twining

Moscow-Soviet Premier Nikita Khrushchev, in rising anger over the U-2 incident, last week attacked Gen. Curtis Twining, chairman of the Joint Chiefs of Staff, as a man to be associated with "an aerial that may do its dirty damage where it will."

Repeating the 1956 visit of Gen. Twining then USAF chief of staff, to Moscow, Khrushchev and the American general was "colored as a guest" and added:

"He left our country by air and not by sea and a plane flying at great altitude to not fly over our territory. This plane flew as far as Kiev (approximately 1,000 mi inside the Soviet Union)."

The question arose—should we protest? I proposed no protest should be lodged. All Twining ought to be compared to us to a man that may do its dirty damage where it goes. From that behavior, we draw a conclusion. To separate rockets, to separate flights."

Gen. Twining was flying at high in 10,000 meters (32,800 ft), but the difficulty of a rocket to fly over us high, it is not easy and might to lead a target in the air, a rocket in the air is like a needle in the ocean.

But a plane flies in target field. This is the advantage of a rocket, and we make use of it. We have high flights and rockets. That is why I say it is not our fault. It is not our fault to be in the air but because they are so dependent on them.

"With up-to-date military techniques, leaders will be told down even before they approach a target."

Earlier, Khrushchev recalled he thought that a U-2 reconnaissance plane flew over the Soviet Union on Apr. 9, adding:

"We should have been down the reconnaissance plane. . . . However, our soldiers was tipped up, to get it safely, and we got them on the carpet."

"I believe our flight over Soviet territory was correct for collecting information on Soviet ground targets and radio stations."

Khrushchev said that, after the U-2 was struck by a "rocket," Powers "broke out by parachute, but he was not spotted by intercept but hit through the upper course. He did die possibly because there was an explosion charge in the aircraft which was to blow the plane in case as the pilot parachuted."

The pilot bailed out and powers was, several days later, was the actor of the plane crew which apparently downed the aircraft. Powers carried the amount of the action.

"High-altitude reconnaissance aircraft are very different and operations directed their eyes and ears to the atmosphere. The target was maneuvering and with each maneuver they job was becoming ever more difficult." Noting that U-2's radio links on the scene were "fairly reliable," French continued:

"The plane plane was firing with almost some speed at very great altitude. A plane, it said, "was equipped the instruments until the target mark was fixed on the plane's course."

"Capt. Khrushchev fully admitted the target flight on a map May 14/1956 version at the command post was given precise parameters at his report. This was given to the air in five."

"The rocket that through the air, shattering all things around and leaving a very trace. Thus there was an explosion in the sky preceding destruction of the American plane in five."

"Gen. Twining has moved onto the plane plane."

Red Sea appeared that the U-2 was equipped with a high altitude, providing sufficient fuel to carry him the approximately 3,000 mi. needed to cross the Soviet Union.

U-2 Missions Approved by Eisenhower

Washington—President Eisenhower last week gave his best approval to U-2 reconnaissance flights over the Soviet Union, after having been informed of the fiscal U-2 positions on such flights and, more specifically, on the Lockheed U-2 last week Soviet visit on May 1. In a prepared statement presented at his weekly press conference, the President said: "The first point is clear. The need for intelligence-gathering activities."

"We also want another President Hoover. This means that we want the leadership of military, naval and police, not others around the world, especially those capable of massive nuclear attacks. Service in the Soviet Union makes this crucial. In most of the world, no legitimate attack could be planned or carried out by the Soviet Union there is a kind of treaty and nonaggression. This is a major cause of international tensions and interests today. Our different must never be placed in jeopardy. The safety of the whole world depends on this."

As the Secretary of State pointed out in his recent statement over the beginning of the Administration, I have agreed directly to permit, in those few feasible ways, the information required to protect the United States and the free world against Soviet attack, and to enable them to make effective preparations for defense.

"The nature of intelligence-gathering activities. . . . These lists are special and secret character. They are so top secret, before the war's outbreak. . . . This is an area because their most successful operations designed by other countries to protect secrecy of military preparation."

"They are devoted from the right to the clear of operational non-aggression to specific detailed activities."

"These elements operate under local directives to seek and gather intelligence that of the one of four-to-six systems approved by acceptable aircraft within the area of secret activities."

"We do not see any Army, Navy or Air Force for this purpose, first to avoid any possibility of the use of force in connection with their activities and, second, because our military forces, for obvious reasons, cannot be given latitude under broad directives but must be kept under strict control in every detail."

"These activities have their own rules and methods of communication which are to be used and observed, just as so the Soviet allegations that are more dangerous. For example, there is a need to believe that this state in question may be shot down at high altitude. The senior agencies of our government are advised of their specific activities or of the special visits to control them."

"Third point. How should we view all of this activity? It is a dualistic but vital activity. . . . We prefer and need, for a different kind of world—and a different way of obtaining the information needed to understand and effectively deterrence. Open societies in the day of present weapons are the only answer."

"This was the reason for my open U-2 proposal in 1955, which I was told, incidentally, by the news editors to avoid actual observation over the United States and the Soviet Union which would raise that no surprise."

attack was being prepared against us, one I shall bring up the open U-2 proposal again at Paris—what it is a matter of making concealment and suspicion."

"My final point is that we must not be deceived from the fact that the U-2 was shot in an incident or a response to the Soviet situation today."

"This incident has been given great propaganda exploitation. The exploiters give it a flight of an unshared insinuation plane can only reflect a detail of secrecy."

"The end stage are the men we will be working on at the present—those nearest, search for solutions affecting Germany and Berlin, and the whole stage of East-West relations, including the reduction of Soviet and Western troops."

"Frankly, I am hopeful that we may make progress on these great issues. This is what we want when we speak of working for peace."

Added: "I have been Secret reconnaissance flights over the western part of the world," the President replied.

"Will I could just say that as far as I am looking, there has given been any over the U-2. . . . Ladies, is right to a query as to whether he is, any chance of access to the Soviet's Soviet Government as far as we're of the strong destruction of the U-2. . . . The President said that the Soviets have been, and primarily so, actively engaged to espionage in the U-2. Refusing specifically to the fact of Secret God. . . . He had hope, because these things have been and for many years, over since World War II, and there is no real change in the matter."

"Name, if a—I wonder how many of you people have used the full text of the Abel trial, the second of the trial of Mr. Abel. Well, I think he was sentenced to 30 years. Now, this has been a case of saying that you're doing things that are provocative, when they had better look at their own record. And I'll tell you this."

"The United States and name of its allies that I know of has engaged in nothing that would be considered anything as provocative. We are looking to our own security and our defense, and we have no idea of provoking any kind of conflict or war. This is not, it is absolutely ridiculous, and they know it."

The President was also asked if he planned to order acceleration of the development program for the Air Force. Miles and Soviet reconnaissance

satellite systems. Eisenhower replied: "Well, I know of nothing new, I keep in touch with our scientific advisors, scientists and operators, and I know of nothing we could do to speed these up. There are records there and at such, but no one really exactly what would be their degree of efficiency. So I couldn't make a real prediction of what is going—how useful they are going to be."

In reply to another question as to whether the satellite systems "will cause more havoc on the part of secrecy," the President said:

"Well, I can't predict what the final results will be. Now we do know this right now: I believe

it's other ways that is sending back, especially pictures on the cloud area of around the earth and that is not usually a rather rough example of what might be done in photographs, but that is being done currently, and I don't know how many thousands of photographs have been taken, and they send them back on microwave."

"I can't predict what the final results will be. Now we do know this right now: I believe

U-2 Developmental and Operational History

- U-2s landing in Japan reportedly later by a 16-year-old boy standing at the end of the runway.
- Apr. 17, 1958—NASA personnel finished final ground test on U-2 satellite reconnaissance. This paper, NASA Memo 6777A, was entitled "Analysis of Measurements of Atmospheric Variables at Altitude: From 26,000 to 55,000 ft. for Four Geographic Areas." These were West Virginia, Europe and England, Alaska, U.S. and Japan.
- Sept. 24, 1958—U-2s were used as reconnaissance behindland high-altitude aircraft in the Pacific. The U-2s were flying over the Pacific Ocean and were seen by the crew of a ship and a plane and it was reported that at least one of them flew almost every day.
- Nov. 25, 1958—New York Journal-American published an article by George Conant on U-2 reconnaissance over Korea which suggested that U-2 flights were being made over the Korean Peninsula. The Soviet Aviation Division U-2 strategic reconnaissance aircraft with the U-2 and got some of the details of the aircraft. The Soviet newspaper quoted Conant's article and other material which had appeared in *World Aviation News* in March, 1958.
- May 1, 1960—U-2 first flight at Altitude. Turkey, reported seeing plane May 1 on western coast near Lake Van region near the eastern border of Turkey by U.S. officials in Ankara. Report was critical, Lockheed-authorized pilot had returned by not experiencing trouble with his oxygen equipment. Among plane was officials in Ankara and Moscow.
- May 1, 1960—Soviet Premier Nikita Khrushchev told the Supreme Soviet that a U-2 aircraft has been shot down over Russia. NASA's Washington headquarters reports that it had been shot by the U-2 mission in the Lake Van region near the eastern border of the Soviet border while the pilot was in connection with the mission.
- May 6, 1960—State Department said: "There was no deliberate attempt to violate Soviet airspace and there has been none."
- May 7, 1960—Eisenhower states that the aircraft was shot down by the Soviet Union and that the Soviet Union shot the pilot had been captured and had admitted attempting a photo-reconnaissance mission across the Soviet Union from Finland to Norway. U. S. State Department then issued a statement acknowledging "to his constant critics" strictly prohibited, but made an information-gathering flight over Soviet territory. It is stated that information came from Washington.
- May 9, 1960—Secretary of State Charles Warren stated that U-2 reconnaissance planes have collected information on the Soviet Union by flying along its borders and "no account is permitted." Khrushchev indicated the U-2 will continue with flights which he has ordered under broad directives from President Eisenhower.
- May 10, 1960—Soviet Foreign Minister Andrei Gromyko is seen a broad area of pilot over the U-2 incident to the U. S. Embassy in Moscow.
- May 11, 1960—President Eisenhower at his weekly press conference was asked approval to reconnaissance flights over the Soviet Union and the reasons the U.S. believed they are necessary.

President's Visit in Doubt

Memo-for-File Premier Nikita Khrushchev indicated last week that he may be considering the withdrawal of his invitation for President Eisenhower to visit the Soviet Union in June.

Reverting under circumstances in which he had taken pains to disassociate the President from responsibility for U.S. reconnaissance missions over the Soviet Union, Khrushchev told reporters that his opinion of the President has changed sharply "of course."

Khrushchev, leaving a box of an exhibit in Moscow's Clark Park along the edge of the Kremlin, U-2 damaged one Southwest on May 1, was asked if he still wants President Eisenhower to visit the Soviet Union. He replied:

"What would you like to see to say? Get up here on my plane and, right?"

"The difficulty is not I say I finally—that my legs are like here now been injured."

"After all, I am responsible for the Soviet government. The Russian people are appointed. Can I expect them to welcome him as a guest?"

I would be glad to see in the Russian people to welcome in a host a man who sends espionage planes here."



Minuteman ICBM tethered test vehicle is fired from a silo at Edwards AFB, Calif., out of seven successful firings (AW May 9, p. 26). Improved nose cone is to be built. The vehicle is tethered by a nylon tether which stretches the light into a few seconds.

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Space Technology

Pioneer Switched to 150-Watt Unit

Windsong-Pioneer V began broadcasting space data through its 150-watt transmitter last week, but before troubles have dissipated prospects of getting useful data from the space probe at distances as great as the hoped-for 50 million mi (AW May 9, p. 32).

National Aeronautics and Space Administration turned on the 150-watt transmitter after data broadcast from the five-watt transmitter became almost useless and when it became apparent that the probe's batteries are depleting. Pioneer V was 5,001,800 mi from earth when the 150-ft Jetrol Bank radio telescope at Manchester, England, successfully got the first transmission from the 150-watt unit.

Since the larger transmitter draws a great deal more power than the five-watt unit, ground stations can intercept the probe for only a few minutes every six to eight hours. Broadcasts begin when battery power is at 25 volts, and the system has an automatic cutoff that terminates transmission when power drops below 15 volts. That was cutting off transmissions from the five-watt transmitter just before the shift was made to the larger unit, and last week it was halting transmissions to reach a seventh and a half.

NASA deduced from this radio-telephone power drop that the 26 battery

cells are leaking. One theory is that the weakest cell is the battery's leading edge two months in space.

Following the switch, Manchester could receive data at the rate of either 3 or 64 bits per sec. Both Manchester and the station at South Pole, Hawaii, were taking data at one bit per second before the switch. The data received at Hawaii had been available for two weeks, and the data at Manchester had become a year old.

The station at Hawaii will continue to receive data at one bit per second. At this rate, it takes 44 min to get a complete packet of data on the actual channels used by the Pioneer V telemetry system. A complete packet can be obtained in 1.5 min, at 8 bits per sec, and in 32 sec at the 64-bit rate. At distance minimum, Hawaii will cut off reception and Manchester will be ordered to intercept one bit per second. Data-taking power will be so difficult to obtain data at that rate.

The five-watt transmitter had broadcast 108 hr of data before the change was made to the 150-watt unit. At its highest rate, the smaller unit broadcast 2.5 hr of data in a single day; it was down in about 60 min just before the change. NASA can get only about four minutes of data a day from the larger transmitter because of its greater power

demands and weakening power supply. Manchester station commanded the 150-watt transmitter on and received the first transmission about 1.5 min later than the time a tick for the command signal to switch the probe and for the responding broadcast to reach earth. This switch transmission followed a sequence of command signals which prepared the 150-watt system for use.

The day before the first transmission, Manchester commanded power into the probe through a resistor, warming the elements for about a minute. Six hours later, this step was repeated without the resistor, supplying full electrical heating for several minutes. First transmission commenced one hour from Manchester early the following day, May 8.

Windsong and its receiver system after receiving data in space for two months. Packaged to the probe by Space Technology Laboratories, the transmitter was constructed by Spectro-Tek, Inc. It uses Radio Corp. of America tubes and is served by a converter built by Engstrom Magister, Inc., a division of Gulton Industries, Inc.

Earlier, a malfunction had been detected on the Pioneer V system, and a warning was devised of overspending for it by switching the data. Red component was a diode in a temperature-measuring system which produced a battery temperature reading too low for its operating battery. Since the batteries were operating, the trouble was traced to the temperature-measuring system.

Morane-Saulnier May Build New Seven-Place Jet; Studies Market

Paris-Morane-Saulnier, builder of the successful four-place MS 700

"Paris" jet executive aircraft, has decided to begin construction of a seven-place transport executive aircraft. Designated the MS 861, plans call for the installation of two Pratt & Whitney JT12A3 turboshaft of 1,000 hp thrust each. With a top speed of 385 mph and a cruising speed of 340 mph, the MS 861 is designed for a normal operating speed of 1,600 mi.

Scipio Saulnier, company sales director, told Aviation Week the decision to move ahead with the seven-place transport depends on the outcome of an international market study now being carried out in the U.S. and elsewhere. Purpose of the study is to establish whether a market exists for at least 100 MS 861s. Based on this reconnaissance, the company is considering a price of \$10,000,000 for the first. Five airplanes complete construction for

11 R. navigation and automatic flight. Besides the seven-place jet, the company has some competition and that attention is being given to increasing. Fuel efficiency schedule to launch the project will be taken in the near future. If approved, the company expects to fly the prototype within 18 months and roll out the first production version within two and a half years.

MS 861 bears some resemblance to an executive jet, the four-place MS 700 in fact. Morane-Saulnier designed the MS 861 to top a market it originally had hoped to capture with the Paris. The latter model, of which 50 have been ordered to date, by civil and military forces in 11 different countries, hasn't made much of a dent in the executive aircraft market.

In the U.S., for example, despite close ties between the French company and Beech Aircraft—only for Paris aircraft have been sold. Morane-Saulnier



Four-engine turboprop transport would carry six passengers plus pilot. Seats, lavatories and baggage compartment are shown in cutaway.



AVIATION WEEK, May 16, 1970

MS 861 Specifications

Weight	
Empty weight	6,617 lb.
Gross weight	12,742 lb.
Dimensions	
Span	36.00 ft.
Length	38.00 ft.
Height	10.00 ft.
Landing gear track	9.81 ft.
Wing base	15.81 ft.

Powering	
Motors diameter	54 in.
Engine diameter (shaft)	93 in.
Cabin length	12.4 ft.
Wing area	215 sq. ft.
Aspect ratio	7
Stowback	27 ft.

MS 861 Performance	
Cruising speed	340 mph.
Maximum speed	385 mph.
Level speed	340 mph.
Rate of climb (20,000 ft.)	3,500 fpm.
Range (40 mph. headwind)	30
Max. delay 50 mi. distance	6,400 mi.
Takeoff distance	2,140 ft.
Fuel capacity	811 U.S. gal.

efforts toward the main reason is that the Paris' passenger capacity is too restrictive.

In going to six passengers, plus pilot, with the MS 861, Morane-Saulnier thinks it has the right formula to attract a large portion of the executive aircraft market. The idea is to provide a faster aircraft capable of handling white-hot traffic, so able to take off from small airports. MS 861's lowest distance is just over 2,000 ft.

With a gross weight of 12,742 lb., Morane-Saulnier says the five Pratt & Whitney JT12A3 turboshafts should give maximum take-off range for single-engine operation.

Seven-foot wing consists of two outer panels each attached to a center section constructed integrally with the fuselage. Inboard ailerons are located in the wing panel and the center section. In addition, each outer wing panel has a fixed fuel tank fitted into the leading edge.

Fixed fuel capacity is 811 gal. Cabin is pressurized and air-conditioned by hot air bleed from engine compressors. Cabin pressure is held at 7.75 ft. H. The MS 861 cruising altitude is 24,000 ft. Oxygen equipment is installed for pilot and all passengers.

In addition to 14 on 14 ft. of baggage space provided within the cabin, six overhead bins are provided in the rear of the fuselage.

Landing gear is retractable and uses a type of automatic power for landing on grass runways.

First Photos Show Titan Second-Stage Ignition



Boosters of the first stage are jettisoned (1). Successful ignition of the Titan second stage at high altitude is achieved for the first time in a test flight (6). Explosive bolts hold the two between the first

and second stages and a pair of solid propellant JATO boosters jettisoned on the second stage accelerate the second stage away from the first (7). After ignition of the second-stage SR-6000 boost-

ers and second stages and a pair of solid propellant JATO boosters jettisoned on the second stage accelerate the second stage away from the first (7). After ignition of the second-stage SR-6000 boost-

Air Force Outlines Plan for STL

Washington—Details of a plan to form a new task force responsible for providing technical support for Air Force ballistic missile and space programs, a task force performed by Space Technology Laboratories (STL, Mar. 7, p. 127), have been presented to the House Military Operations Subcommittee. USAF Under Secretary Joseph V. Clark told the subcommittee that negotiations currently are under way to acquire existing STL facilities with an estimated value ranging from \$20 million to \$30 million, while at the same time an Air Force planning group is working out details of complete visitation, organization and staffing.

The new organization will not perform in the same manner as STL, Clark said. The corporation's role is an actual development program with a staff function in a transfer and technical advisory to the Air Force, contrasted to the present situation where STL has a line system engineering responsibility.

Functions to be assumed by the new corporation under Air Force program

management, Clark said, include advanced systems studies and planning research and experimentation, initial systems engineering, initial technical direction and technical monitoring in the field of man-made space systems. In addition, Clark told the subcommittee, led by Rep. Clot Oldfield (D-Calif.), that the corporation will provide assistance in the evaluation of new ideas and proposals submitted by industry in order to ensure the proper interaction between military requirements and technical capabilities.

Detailed Analysis

"The detailed analysis, together with supporting experiments," Clark said, "will provide the soundest possible basis for the initial engineering specifications of a system, including the subsystem requirements, specifications, instructions and interfaces."

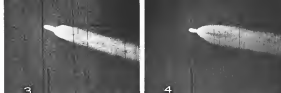
Clark said the new corporation also will play an important role in the evaluation of the contract proposals "and to provide the Air Force with the best

technical assistance for the selection of the contractor who will have responsibility for the detailed system engineering and the major role in systems construction."

After the contractor has been selected and the development program launched, Clark said, the new corporation—through technical review, monitoring and analysis—will attempt to ensure that technical deficiencies and weaknesses are isolated that the impact of new data, new developments and modified requirements on the total system concept is properly assessed, and that appropriate changes are introduced as promptly as possible.

In the transition from the present system, Clark said STL will continue to retain detailed systems engineering and technical direction by the Convair Atlas, Minuteman Titan and the solid propellant Minuteman ICBM program.

Lt. Col. Ronald A. Schenck, commander of Air Research and Development Command, told the subcommittee that a lateral movement of individuals of "intelligence and status" would be expected to establish policy and run the program headed by the new group.



Double-chambered SR-6000's thrust boosters has lengthened to about 50 inches the 40-inch long nozzle (3). First stage thrust transients are beginning (2). Inflowing and lengthening of the exhaust from boosters further during the process of thrust transition

(3 and 4). Exhaust pattern appears in the exhaust in the mirror from the deep attitude of the rocket nozzle (AW Jan. 4, p. 66). Spinal view is approximately 3,500 mph. Second stage ignition is progressing to begin its nozzle after end of first stage thrust.



Aerjet LR-91 engine the second stage drives away from the first (5). Shock wave forms on the second stage (7). A. Downward velocity at nozzle's weakest expansion is more than 17,000 mph.

Venturi effect in stage two provides 900 ft of thrust after shutdown of the main propulsion units for final velocity adjustments (AW Feb. 11, p. 16).

Mercury Tests Begin On Production Capsule

Washington—Partially-equipped production version of the Project Mercury Capsule was flight-tested for the first time last week in a simulation of an escape from the launch pad.

Mercury capsule was boosted from National Aeronautics and Space Administration's Wallops Station by its escape rocket, and it was accelerated and turned to the north within 17 min. The capsule was the first production model delivered by McDonnell Aircraft Corp. It was equipped with escape recovery, communication and electrical systems, but it had no egress means in emergency system.

Next phase of the Mercury flight test program will involve suborbital flights boosted by Liftjet Jet and Atlas-vehicle Atlas base will provide an engineering evaluation of the launch complex designed to compensate for loading on the hardware. Little Jet flight will carry a chimpanzee in a capsule equipped with the life support system.

Capsule tested last week was delivered to NASA on Apr. 21 and assembled from McDonnell's St. Louis plant to Wallops Station (AW Apr. 25, p. 32) for a series of component check-out and to be prepared for the test flight. McDonnell currently has a contract to deliver 36 capsules, and NASA plans to make four more.

On the launch, the capsule was attached to an adapter by the type of clamp ring that will attach the manned capsule to the Atlas booster. Scrambling a launch pad escape maneuver, the escape ring was released by explosive bolts, and the escape rocket boosted the capsule to an altitude of about 3,400 ft over the Atlantic Ocean. Drogue parachutes were deployed two seconds after explosive bolts separated the boost-out escape jacket and tower from the capsule. Main chute was deployed two seconds later, and the capsule landed about three-quarters of a mile off the launch complex site.

Capsule was recovered by a helicopter from Navy Air Group 35, part of the Navy Project Mercury Recovery Force.

News Digest

Kennedy-16-436 Hercules testbed powered earth rescue helicopter, being grounded by USAF. Miss V because of isolated clearance between rotor and fuselage, check have been set by labors.

ACF Industries, Inc., has acquired 214,000 shares of Republic Aviation Corp common stock, from the estate of the late Paul Monroe, a Republic executive. Most will strengthen ACF's position in the field of military-powered rockets, considering Republic's research in that area, according to W. T. Taylor, ACF board chairman.

Atlas-D suborbital testbed missile programmed for the Wallops Island target was destroyed at 3,000 ft after an escape flight. Missile was launched by a crew of the 34th Strategic Missile Squadron from F-4C's F-4C, W-4.

Airlines Protest FAA Recorder Ruling

ATA hedges proposal on grounds expense will not justify the 'slight benefits' to the investigations.

By Robert H. Cook

Washington—Airlines operators are making a last-ditch stand in an effort to delay Federal Aviation Agency adoption of a ruling that would require the mandatory installation of flight recorders on all turbine-powered aircraft by Sept. 1.

Opposition to the proposal, which is aimed primarily at the Lockheed Electra, Funchild F27 and Vickers Viscount turboprop aircraft since they already are mandatory on turboprop equipment, is led by the Air Transport Assn., on grounds that the installation expense and maintenance problems will not "justify the slight benefits to accident investigation." The organization also contends that many of its members have been considering such installations and suggests that FAA stay adoption of the proposal for approximately one year to permit the carriers to evaluate and purchase more sophisticated recorders than those now available on the market.

However, adds that ATA's request will be granted appears thin, according to information from the FAA Administrator E. R. Queen. She believes an agreement stands on her belief that recorders should be installed on all airline aircraft as soon as possible. Recent series of airline accidents, highlighting the possibility of clear air turbulence as a possible cause factor plus strong urging by the Civil Aeronautics Board that recorders be carried in so as to avoid investigations, make any change in FAA rules very near certain.

Why an Amendment?

While FAA said that its Sept. 1 authorization date was subject to review if the "availability and extent need for flight recorders, the agency's notice of proposed rule making revealed that the need for rule amendment was a matter of ongoing concern. Original rule, adopted Sept. 5, 1957, was expected to cover both turboprop and turbine aircraft as the theory that both types would be operating above 25,000 ft. altitude.

However, FAA explained, certain types of turbine-powered aircraft have been subsequently certified to operate at or below this altitude and have not been required to carry flight recorders.

As an example, one FAA spokesman pointed out that the Lockheed Electra was originally scheduled for certification to operate at 20,000 ft. but was finally restricted to 21,000 ft.

Further provisions of the proposed amendment require the certification of operation of recorders during flight and R

center of recorder information for at least 60 days.

CAR comments on the amendment called for a broadening of the regulation to require recorders on all new transport aircraft, regardless of the height at which they are operated, along with all new transport aircraft on existing aircraft. The Board also urged that the application apply to training, towing and ferry flights of airline aircraft, since the transport might sustain damage and status could not be readily represented in normal operations.

In addition, CAR wants the equipment to be operated below the altitude which leaves the ground on takeoff.

FAA spokesman Representative Ann Quisenberry told FAA the regulation should be tailored more to aircraft speed than altitude because of the effects of gust load factors. The stated said installation of recorders upon existing aircraft also would aid in determining the cause of "repetitive" overcasts or open air turbulence.

FAA spokesman explained that the rule would be able to record land landings and apply them to all aircraft with a takeoff weight above 12,500 lb., regardless of the type powerplant used.

Air Line Pilot Assn. says the FAA proposal for landing but not flight recording should be said in all aircraft operating as airway-sound instrument flight rules.

ATA said its stand against any amendment change in the regulation is "all the more valid" when applied to the operation of recorders during flight and R

air aircraft would not lead server operators \$150,000 in actual costs without causing maintenance expense, ATA spokesman said.

The organization said the "airline" information supplied by member carriers indicates many carriers would be unable to meet the Sept. 1 compliance deadline and would be forced to receive a six-month grace period.

Types of Recorders

Many airlines are interested in a multifunctional magnetic tape recorder which could provide operations and maintenance information beyond that needed for accident investigation, according to ATA. Timetable act for recorder installation, ATA said, is based upon the use of hardware such as Lockheed four-channel recorder now used by a number of airlines.

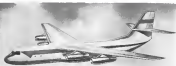
ATA said it favors purchase of a magnetic tape recorder being developed by the Massachusetts Instrument Co. which can supply them in 10 or 20 per month beginning Jan. 1 on a cost out of about \$10,000. The company plans to conduct a test flight for FAA demonstration by the end of this month, ATA said.

Favoring the use of a magnetic, multi-channel-type instrument, ATA said its talks with Massachusetts Instrument Co. suggest that those interested in this rule could complete installation and evaluation studies by July or August, 1961.

In the meantime, ATA said other carriers could go ahead and install the currently available recorder, but that, should the FAA indicate a regulation change, those devices which would be forced into using the current units and would be instantly unable to connect to the magnetic tape at a later date.

ATA also requested that F-27 operation in Hawaii and Alaska be excluded from the proposed amendment because it said similar weather conditions common to the U. S. are not prevalent in those areas.

Filing by Lockheed Aircraft Service, Inc., with the FAA indicates that the firm's Model 104C recorder will be available at the rate of 24 units a month by the end of this month, according to a 1961 month by August, according to \$12,400 for 10 units, including installation, were for the Electra. Cost for the Viscount would be twice as high for F-27 and Cessna CL-44 recorders, a bit lower, the manufacturer



ADVANCED VERSION of the Lockheed CR-207 Super Hercules, powered by four 23,000-hp Pratt & Whitney JT1D-14 turboprop (AW Aug. 14, p. 22), is being prepared by the company's Maestri Co., Division in a USAF Military Air Transport Service ferry transport with maximum payload capacity of 77,000 lb. Lockheed/Maestri says that ferrying planes would be \$5.8 million on basis of 30 units, \$4.9 million on basis of 100 units and \$5.5 million if 145 are ordered.

MATS Procurement Plan Calls For Initial Order This Summer

By Katherine Johnson

Washington—Air Force last week promised to Congress its timetable for modernization of the Military Air Transport Service cargo fleet and new MATS contracting policies aimed at streamlining the purchase of modern cargo planes by the service.

Robert B. Taylor, assistant USAF secretary for material, made it clear to the House Government Military Operations Subcommittee that Air Force plans to build up and maintain a modern MATS cargo capability at a cost of "under" a billion dollars and that there is an adequate operational cargo fleet for backup in an emergency. He also said that MATS intends to retain this in general preference ratio of five large to one medium-size cargo plane.

Taylor pointed out that a determination on the "budgetary" status of MATS—the key to its future—now is scheduled to be made by the Joint Chiefs of Staff in September. The JCS review is now under way.

MATS Plan

This is the MATS procurement plan Taylor outlined.

- Selection of the aircraft to be the future backbone and workhorses of MATS will be made "shortly after July 1." Proposals have been submitted by several companies. From these, Taylor said he will "select approximately" that an aircraft meeting MATS requirements—providing original loading equipment, touch-down light cargo floor, capability for short-field operations and loading of cargo and personnel—and also meeting

fuel low operating cost requirements of commercial carriers—can be developed? The House has already approved \$50 million in the fiscal 1962 defense budget for initial development and engineering on this aircraft. Taylor estimated delivery on the aircraft should start in mid-1964.

Taylor estimated that by Oct 1 USAF would give the selected manufacturer the go-ahead for production of 100 cargo aircraft for the interim modification of MATS. These aircraft would be available to MATS early to 1962, and deliveries would be completed by the end of 1963.

Taylor indicated procurement of 50 Lockheed C-130Bs "but gave no indication as to the aircraft type which might be favored by USAF for the remaining 50 aircraft to meet MATS cargo requirements," spokeswoman. The House has voted \$70.4 million in the fiscal 1961 defense budget for the C-130 purchase and \$25.6 million for production of "the C-130 aircraft at a unit cost of under \$1 million." House Appropriations Committee specified only that "it is intended that the cargo aircraft be a mid-loading, high-altitude will require the least modification, and that provide the most significant decrease opposed by the development of a winged aircraft version.

Rep. L. Mendel Rivers (D-S. C.), chairman of the House Armed Services Subcommittee on air, strategy from the CR-135, led Sen. A. Mike Monroney (D-Okla.), chairman of the Senate Commerce, Airline Subcommittee, is opposed to selection of this type on the ground that its loading area requires

an extra set of steps and the cost of a step adaptation of the truck would be excessive. At Alternatives, Sen. Monroney would like step adaptation of the Boeing 707 or the Douglas DC-8, or the Lockheed C-130, or the Hercules.

In connection with procurement of the C-130 and CR-135 by means of a truck, Taylor pointed out that USAF is studying an alternative "step down" aircraft. Air Force would purchase an alternate aircraft for Canada as exchange for Cessna CL-44s. Gordon W. Reed, board chairman of Texas Gulf Producers Co. and head of a series of studies on aircraft which recently made a study of MATS cargo needs (p. 31) recommended an SBO unless purchase of aircraft is exchanged for CL-44s. Taylor reported that the scope of Reed's proposal was too large, but that USAF "did not discuss feasibility in such terms."

Under MATS new commercial aircraft procurement policies, the type of aircraft to be operated under contracts will be given more consideration, including out-of-the-line aircraft. However, for carriers who have modern equipment. To make this program most meaningful, USAF will generally not negotiate a separate agreement in contracting with an aircraft. Air force will not purchase aircraft from MATS. Contracting which MATS has previously used in the past Taylor noted, where negotiated contracts failed to provide useful services at attainable prices. Preferential treatment will also be given to carriers offering operations capabilities as an asset price.

Common Carrier Notes

Taylor first ruled out raising common carrier rates for MATS cargo contracts and the proposal of direct air service between Northwest Airlines, Southeastern and Western Airlines. Pan American World Airways and Trans World Airlines carriers will be asked to increase common carrier traffic volume on the routes it reduced rates established by Civil Aeronautics Board (AW Nov. 16, p. 47). Using common carrier routes, Taylor said, would triple the common carrier cost of MATS. The four-carrier proposal (this column) is a very one document but it has no price in it and the price in the revised document. He emphasized that USAF would never accept any proposal under which it paid the bill and CAB set the rates. Taylor also objected that under his four-carrier proposal, USAF would be paid back from having a say on the type of aircraft to be used.

As an alternative to the four-carrier proposal, Taylor reported, MATS plans to choose a portion of its traffic to be handled, route carriers on regularly scheduled flights—possibly the common

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6 hrs.
30 MINS

PARIS
6 hrs.
15 MINS

ROME
9 hrs.
45 MINS

FRANKFURT
8 hrs.
50 MINS



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Eastern Shows Interest in Boeing 727

New York—Eastern Air Lines is expected in the Boeing 727 jet transport for operating into smaller airports and one also be interested in "adapting" with a modified Chertkov Lydard V. Reichenbacher and base.

Reichenbacher also discussed before the New York, Bureau of Security, Analysis his opinion on the future of the Lockheed Electra transport in the light of the two or set-up entered accidents, and his unfavorable opinion of some aspects of Civil Aeronautics Board accounting theories.

Boeing has not yet decided whether to build the 727, the problem being living to overcome potential customers to accept the same basic aircraft to avoid widespread production cuts next to program jet transport program (AW May 2, p. 177). United Air Lines and Eastern are showing the strongest interest in the airplane, but American Airlines is also studying short-range jets—the 727 and the Convair Model 440 as well.

Aircraft Requirements

Reichenbacher said Eastern was interested in an airplane capable of operating out of airports with runways of approximately 5,000 ft. and which had traditional made cutaways suitable or adaptable. The 727—now designed to use three turbojet engines—offers the option to have good economy and operational potential, Reichenbacher said.

Specifications for the airplane are laid out there, quoted in articles on design the design started at 105,000 lb. maximum gross and later his rise to 120,000 lb. The Allison-Rolls-Royce ARJ 901 (AW May 2, p. 147) is a strong candidate for the propulsion, but the Pratt & Whitney JT10 turbofan on a General Electric engine also are being studied.

Passenger Configuration

The contract referred to is for customer studies use of the 119 or 140-seat derivative of the Boeing 707, which permits a three-and-three-quarter deck configuration. Length is quoted at 118 ft. 5 in. It would carry 65-110 passengers, 85 second configuration and 114 all-coach.

Convair Model 60 gross weight would be either 146,000 to 145,000 lb. depending on seating configuration. The seating layout, engine, engines, on the fact General might use passenger capacity ratings, would be provided either by the Pratt & Whitney T3D-5 turbofan or the General Electric CJ805-43C fan engine and would have a range of 1,250 mi. and cruise

at Mach 0.91. It would be suitable in Lakeland distance is less than 5,000 ft.—probably under 4,000 ft. and short and medium loads of less than maximum gross weight.

Its United sales would be for 7967 deliveries (AW Feb. 29, p. 41), added then p. 41. The Boeing aircraft would give United four distinct configurations that compares with the Convair at 108,000 lb. and 88 passengers through the Boeing 727 at 145,000 lb. and 116-149 passengers, to the Douglas DC-7.

Reichenbacher declined any comment on Eastern's part in the General Electric program. "It's an airplane built on a foreign load 4,000 sq. ft. We're interested enough with people on our own aircraft, operations and otherwise."

If Eastern orders the 727, it would compete with the Electra, an issue noted.

Reichenbacher said, and the Electra would be used on routes now being flown by Martin or Convair from passenger operations. Eastern also is studying the Lockheed L-107, but has delayed options it held on 30 more Electras.

Electra's Future

Contemplating on the future of the Electra in the light of the TWA City, Inc., withdrawal, Reichenbacher defended the airplane and said he felt any Electra required would not be too great a problem. He and Eastern flights through that area on the day of the crash had been wanted to stay below 11,000 ft. or above 12,000 ft. because of severe turbulence expected near a low-level jet stream and he felt this was a factor in the accident. An Eastern Electra near under the turbulence area and an Eastern DC-7 over it at the time of

Future Doubtful for HFB-314 Jet

Geneva—Short-term future of the Hispano-Breguet 314 medium range jet transport (AW Dec. 26, p. 47) is now looking dimly at a market scene being made by the company of the report of the West German Ministry for Economic Affairs. The survey is expected to be in eight weeks and would include software final decision on whether or not the government will finance further work. Many observers believe that such funding will not be granted and that the project will be dropped shortly within a few weeks.

The government stands in largely unopposed to the financing of Lockheed P-38A and Fiat F4U production and development cost of the Transall French-German medium range transport. It is normally regarded to finance any projects which do not lose a guaranteed future.

Present status of the 70-seat HFB-314 is that of a "paper project" with excellent performance. Spies wanted out with a choice of powerplants: present General Electric T302-D1 turbofan, Pratt & Whitney JT10-D1 turbofan or Rolls-Royce RB 114 turbo engines.

Performance Spies give the aircraft a cruise speed around 680 mph, range approximately 160 and 1,500 mi. and runway lengths on the order of 5,000 ft.

Spies also believes that an order for at least 200 airplanes would be necessary to justify setting the project in motion beyond the study stage. There is one such likelihood of failure that has a market for a study done on the entire world, but also Europe, which was the primary target for the HFB-314 project. What market will exist in the special category will be controlled by a half-dozen manufacturers of jet transports with much more experience behind them.

As presently proposed, the HFB-314 is little more than a flight-tester Convair and will be possible to make in small quantities. The fact Douglas produced, among others, would have to first to reproduce it and reproduce it to offer customer.

Another potential objection to establishing the HFB-314 project is the current and planned projects of the German industry. Most observers believe before the industry has enough to do during the next few years without doing it any further with a new and already unnecessary project.

The HFB-314 design was one of four selected by the West German Ministry from a group of study projects prepared by various design teams for short and medium range transports. The other studies chosen were a modified Convair transport short-range transport in the Douglas DC-7 replacement category. The British design appears to be discarded, and only the Hispano-Breguet is being actively tested.

The HFB-314 project came out of the company's continuing interest in high-speed transport. A number of design variations of the 314 transport were studied and the final configuration was developed about a year ago. Since then, the main part has been being in interest service, but the extent of its success is not known.

COMMUNICATIONS



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Cost Increases

Specific ones where Eastern Air Lines showed cost increases that resulted in a deficit of \$649,819 for the first quarter of 1960 compared with a \$5,111,879 profit for the same period last year were disclosed by Controller Edward V. Rusk relative to the Security Analysts.

Expenses rose 20% overall to total \$17,761,311 as against revenues which rose to \$72,244,107 from \$71,060,073 last year. The bookkeepers, which closely showed the effect of increases to the Lockheed Electra and Douglas DC-8's.

Here is a summary of the increase:
 Fuel and supplies 45%
 Overhaul (including holdup per request by testing program) 62%
 Depreciation 19%

Rickenbacker said that costs had declined slightly because of the greater use of his operating business for routine operations, but he did not believe that the price differential would mean in itself long.

Four other cost increases were also mentioned, but he said depreciation charges, interest, foreign exchange rates and fuel expenses would remain in effect long.

the truck and experienced little or no increase, he said.

His comments on the integration of transportation services came during a discussion of the long range future of the airlines in which he pointed out that perhaps the time had come now to look at transportation as a whole, rather than dealing with rail, air and steamship policies as separate.

A basic advantage might come, he felt, in integrating domestic travel, air bus and railroad as intermodal air lines and shipping companies—not necessarily by merger but through stock participation. As air cargo expands, airlines will have to duplicate all great cost handling systems already in contact for railroad or shipping. Savings now would obviate this duplication.

As for merger, he said Eastern is interested in getting two things—control power and leadership. "If we can get both, we're interested," he said, "and we might be willing to let the other fellow take the lead."

April produced some "real numbers" when system load factors rose to 50%, he said, and he felt that trend would continue. Eastern is being in request for a day schedule under the new rate of return except on a 60% load factor, which he indicated would be an excellent overall average for Eastern's presently scheduled routes.

DC-8 load factors had risen to 60%, he said. On the Electra, prior to the Tull City accident Mar. 17, they were

running 57.65%. From Mar. 15-31 they ran 51.44% and for the month of April, 52.54%. Rickenbacker said the latter figure was a good average since load factors for the first two weeks of the month were in the low 40%.

Rickenbacker was highly critical of CAB-sponsored accounting changes, as related views of pilots expressed for example. "We had reactions there around value to 15% loss 5% when we should have written them down to nothing because that is what aces do doing it their own," he said.

He would say that the same problem, he added, for aircraft companies in the next 10 years over which the equipment is being written off. He said the maximum depreciation period for a jet transport should be five years. He also felt derision of some air transportation and of interest charges on funds loaned for program payments were "wonderfully increased" in the CAB. "It's fundamentally not good business," he said. "When I spend money, I like to charge it off."

Eastern in 1959 delivered \$1,927,000 in transaction costs and \$411,000 as interest costs for amortization over a period of years. Combined with a charge in computing deferred income taxes Eastern's 1959 net income was \$3,016,300 higher than it would have been under previous accounting methods.

Britannia Crash Cause Undetermined

LONDON—Private cause of a crash of British Britannia G-ANCA Nov. 6, 1957, at Downend, Reading, cannot be determined, British Ministry of Aviation said in its official investigation report last week.

The report stated: "The accident was the result of the accident developing a very steep descending turn to the right which the pilot was unable to control. The reason for this could not be determined, but the possibility that it occurred as a result of a malfunctioning of the autopilot cannot be dismissed."

Investigators noted a design fault in the electrical circuitry. Short-circuiting of the recorder in one fire incident involving a Britannia, in which recovery was made only after autopilot power was restored, was noted. Since that was restored in both cases, the report said.

Report was completed by British Air Test Division, aeroblog headquarters, which agreed that changed condition of components could still be consistent with damage due to the crash. The report concluded that the autopilot failed to disconnect although proper switches had been activated and that a time-lagging lock had altered before impact.

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SHORTLINES

► **Aldon**, the Tulsa airline, has accepted delivery of the first of its fleet of six Douglas DC-9 turboprop transports — some 16 would proceed to Salt River, Georgia, bypass engines. As of Apr. 25, 47 DC-9s had been delivered. Aldon was the 11th airline to accept delivery.

► **Allegheny Airlines** is consolidating its sales and service management under the direction of L. T. Ferguson as general sales manager and Robert C. Schuara as general manager-transportation services. Reason for the consolidation "is based on a concept of 'win through service'."

► **Continental Airlines** is adding five Boeing 737 passenger cargo flights on its Chicago-Denver-Los Angeles route this month, increasing its jet air freight capacity to 560,000 lb, a gain of 36%.

► **KLM Royal Dutch Airlines** reports 54.2 million net enroute flight for the 12-month period ending May 31, a gain of 5.2 million over the previous 12-month period. The carrier, however, has reported a net loss of 52.2 million for the first quarter of 1980 despite an increase in operating revenues—which climbed 14% above the same period of last year to 538.8 million.

► **Southern Airways** is planning a new administration building at Atlanta Airport, with occupancy scheduled by the end of the year. Building will house the airline's sales, operations, training and administrative departments.

► **Trans World Airlines** has received a Civil Aeronautics Board subpoena from the Federal Aviation Act permitting the carrier to serve points in Georgia and Florida from its West Coast as long as the carrier does not provide through-plane service. The Board's subpoena is part of that TWA may serve Miami, Tampa/St. Petersburg/Clearwater and Orlando "as well as flights terminating or originating at Nashville, Texas, or St. Louis, Mo."

► **United Air Lines** reports that it is being an additional 700 maintenance ground personnel and administrative workers to service its expanding fleet. By the end of 1980, United expects to have 53 Douglas DC-9s and 11 Boeing 720s. In 1981, the carrier hopes to add seven more of each type as well as new Douglas-produced 3rd Generals. The airline also plans to hire an additional 700 mechanics this year.

AIRLINE OBSERVER

► **Continental Airlines** President Robert F. Sir is urging Congress to accelerate development costs of a bypass transport aircraft. In a letter to the House Science and Technology Committee, the airline executive contended that a postage Model 3 to Mach 3.7 aircraft could be developed for \$100 million and that the government could eventually recoup development costs by leasing aircraft as all production aircraft. He points out that the British government financed the Vickers Viscount as the same manner.

► **Dispute** between the Flight Engineers International Union and the Air Line Pilots Assn. over the status of current contract talks lets one TWA and Eastern Air Lines. Engineers are now demanding that wherever Eastern sets a three-pilot crew, two flight engineers should be utilized.

► **United States and British** aviation manufacturers do not plan to appeal the International Air Transport Assn. ban on the introduction of IATA's current general meeting in Copenhagen in September, but French aviation manufacturers are pressing to attend on a second-floor basis. Scandinavian Airlines System, the last airline, has indicated that it does not want Scandinavian pressure, and IATA's executive committee is not expected to attend the ban voted last fall in Tokyo.

► **Newark Airport** may receive its first scheduled jet service this summer with the inauguration of Conquest 300 flights by Delta Air Lines. Publicity from the airline's summer schedule apparently is swerving Post's New York Airlines approval of jet service into Newark. Approval would probably permit Delta to provide the service structure in July. Meanwhile, Delta plans to begin 380 schedules between Minneapolis, Chicago and New Orleans on July 1.

► **North Central Airlines** plans to purchase an additional five Conquest 300s this year and expects to expand its Conquest fleet at approximately this rate for the next several years. However, there are no plans to convert the aircraft to turbojet configurations for at least three years, the airline reports.

► **Five American World Airways** pilots were rejected by Federal Court order last week, not to enforce flight that night unless more than 5 hr of duty time is not 24 hr period. Rejection order issued by Judge Kenneth C. Christie in Miami, Fla., against the Air Line Pilots Assn., found that ALPA efforts to prevent the pilots from accepting night flight constituted illegal interference with the airline's business and single-seat contract which does not expire until Aug. 24. No date was set for a further hearing.

► **Flight Engineers International** Assn. officers and 39 FEIA members at Continental Airlines are being sued by individuals by the airline. Complaint filed by the airline in Federal District Court of Los Angeles alleges that telephone solicitations dropped from a bank of 500 calls to 150 in the following six weeks in recent public threats to strike the carrier.

► **United Airlines** agrees to end work to extend positive control of aircraft along three transcontinental routes from the present upper limit of 22,000 ft to 34,000 ft in the long range radio-controlled zone of Chicago/Indianapolis. Lower limit would remain at 17,000 ft. Under a proposed regulation amendment scheduled to go into effect by Oct. 15, aircraft operations in the control area would require aircraft to be equipped with radio beacon transponder as an identification aid plus radio equipment used to a specific frequency providing direct communications between pilot and controller.

► **British Overseas Airways Corp.** will cut its spending New York-Nassau fare from \$149.10 to \$123.64 on May 22. New fare applies to B.O.A.C.'s Monday morning transit class extension for summer and autumn months and expires Dec. 15.

Space probe reaches
heights of over 500 miles—
speeds of over Mach 10—
with unprecedented reliability ...



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One of the largest manufacturers of motive power units in the world, Bristol Siddeley Engines Limited produce the Gazan. A liquid propellant rocket engine, the Gazan powers the Scimitar (the Black Knight), Britain's highly successful space research vehicle. An extremely reliable powerplant, the Gazan produces a total sea level thrust of 11,400 lb (7,835 kg) and nearly 19,000 lb (8,618 kg) outside the earth's atmosphere, for a total powerplant weight of only 700 lb.

The Gazan has sent Black Knight over 500 miles into space at speeds in excess of Mach 10 with a reliability that is unprecedented. For, to date, the Gazan has never failed to fire successfully.

Since Bristol Siddeley's rocket division began work in 1945, it has developed a wide range of components. By combining these components in single or multi-shaft layouts, thrust requirements from 500 lb up to 100,000 lb can be met.

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Bristol Siddeley Maybach diesel engines power the British Railways "Dieselol" Type 35D5-H engines, developing a total of 2,200 hp, give the "Dieselol" a top speed of over 90 mph.

The Bristol Siddeley Gryphon, the world's most advanced light-weight turbojet engine, powers the Fiat G-91, NATO standard light-weight strike fighter. The Gryphon is in service in six different variants and is specified for eight others.

The Bristol Siddeley Proteus powers the Boeing 747-100. Four Proteus give the 180 seat airplane a speed of over 600 mph—a range of over 3,000 miles. Performance can be increased with turbochargers and with RFP (Reciprocating Compressor).

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First of new Jet Caravelle Mk. 1s is delivered to Swissair. Aircraft is powered by two Rolls-Royce Avon Mk. 522 turbojets, rated at 19,900 lb. wet thrust, static thrust each.

Caravelle Versions Include Fan Engines



New growth routes of General Electric CJ405-21 turbo engines, the CJ405-23, with total thrust rating of 26,000 lb. will be fitted to Jet Caravelle Mk. 7 jet turbojet powered by GE for limited use (AVR. May 2, p.119). Engines is rated at opening FAA certification of the all fan Caravelle which will be sold in both Jet and Douglas Air craft Co. Configuration of the aircraft will allow engines at doors on center. Two engine craft, push and pull will be produced by Douglas for the Jet CJ405-21s. Douglas will deliver these aircraft under a \$1.1 million contract in November. Specifications on Caravelle Mk. 7 include a maximum cruise speed of 340 mph and range of 2,500 mi.



Atlanta has Jet Caravelle Mk. 1s on order. Jet is shown above and is fitted with same equipment as helicopter. Designated as Rolls Royce Avon Mk. 521s of 17,700 lb. thrust.

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AVIONICS

Component Reliability Practices Proposed

By Philip J. Klein

Washington-Specific measures for improving the quality and reliability of electronic components and reducing the time required to prepare and bring up to date military specifications will be available to industry within 60 days.

First details of the measures, the result of a two-year Defense Department industry study, were disclosed here at the Electronic Component Council conference.

The recommendations, if adopted, could have a profound effect on production of electronic components. Manufacturers of defense electronic equipment and users of such equipment, however.

Here are some of the new practices recommended by the Air Force Study Group on First Specification Strengthening for Reliability.

- Reliability level of electronic components will be specified on contracts and drawings, along with tests which must be performed by the component maker to assure that components meet specified reliability levels. There will be different reliability levels expressed as failure rate per 1,000 hr: 0.010%, 0.050, 0.10% and 5% where the latter figure depends upon the specific component type.

- Qualification approval will not be given to a new component which on the basis of tests of a few hundred samples is in the just "initial component make" will be required to submit to a limited failure agency all data from acceptance tests performed on subsequent production. If production units exhibit a higher failure rate than original samples, the manufacturer will be delisted as being a source with long-term reliability assurance. If, however, subsequent production exhibits a

lower failure rate than early samples, then the manufacturer can request a new listing as a supplier of high-reliability component.

- Component manufacturers would be required to provide their customers with acceptance test data which has been certified by a responsible company official.

- Permanent advisory groups, reporting to the Assistant Secretary of Defense for Supply and Logistics, is recommended to carry out the new program to coordinate and speed up the program and screen all military component specifications, and to work in a limited information exchange agency to collect and disseminate data on end item orders and the military on component failures and component applications information.

After a two-year study, the all-branch committee headed by Paul S. Harrell of Bell Telephone Laboratories, has



Soviet Trawler Photographed in U.S. Test-Firing Area

Soviet trawler Vega, equipped with tracking radar and probably some equipment, was recently photographed by a U. S. Navy patrol plane about 60 mi. south of Long Island, N. Y., on a test where the Polaris submarine George Washington was test-firing missile launchers. Secondary mission of the trawler apparently was to gather information on the George Washington's speed, course, etc. The same mission, however, is believed to have been the main reason for the monitoring of U. S. ships and communications equipment. Visible antenna on the X-100 level was tracking antenna and a direction finding antenna located on the superstructure above the bridge, communications antenna are strung between two masts.

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The Specs

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- 0-20 rad/sec² 100-cps natural frequency (70° lag)
- OUTPUT, FULL SCALE** ±0.25 volts/accel at 12,800 ohm load
- RESOLUTION** 0.01% full scale or better
- LINEARITY** 0.1% full scale
- HYSTERESIS** Less than 0.01% full scale
- SCALING** 0.4 to 0.1 of rated
- SIZE** 3 7/8" diameter x 3 1/2" high
- WEIGHT** 2 pounds



Lear Develops Gas-Driven Gyro

Gas-driven gyros for missile use with short flight time developed by Lear, Inc. now offer a solid or liquid-filled cartridge, electrically gimballed, to drive radially about at 12,800 gpm. The two-degree freedom gyro provides 50 deg./sec (roll) about outer gimbals and ±75 deg./sec about inner gimbals. With an angular acceleration of two million Gm, zero gyro drift rate is 0.121 deg./hr. about outer gimbals and 5 deg./hr. about inner gimbals about zero gimbals when subjected to high roll rates. Gyro is mounted electrically and senses up to speed in about 0.1 sec. can be operated at ambient temperatures of -40 to 140°F. The inner-to-outer gyro weighs 16.6 ounces at 10.4 x 4.5 x 5.0 in. long. Exploded view shows relative line pitch in the new Model 1096C gyro.

ended that military specifications have failed to provide equipment manufacturers with up-to-date reliable components because of the lack of effort or suitable organization in DOD and in the three military services.

The military services have issued most parts specifications and standardization programs only as guidelines of facts and have not given them the status, attention and resources they deserve in view of the tremendous dollar savings and greater reliability they could make possible, the report says.

Because of the difficulty of getting agreement between the three services, it sometimes takes 18 months to work out a jointly acceptable military specification. In this case, the cooperation described in the specification briefings has been outstanding by a new development.

The report therefore recommends the formation of a permanent Advisory Group on Management of Electronic Parts Specifications (AGMEPS), an outgrowth of organizations of interested agencies in the Office of the Secretary of Defense, the three military services, and industry.

The proposed group would report to the Assistant Secretaries of Defense for Supply and Logistics. Its function would be to review all Defense Department programs for parts specifications management and make recommendations on detailed documents for implementation the program recommended by the ad hoc group.

Approval of a new specification would require only a majority vote, not unanimous approval of the three services as in the past, according to the researchers.

Responsible for preparing military specifications presently is assigned to the Armed Services Electronics Agency but it is pointed out that the three services do not report to a single "boss" in the Defense Department.

Although the report notes that Quality Assurance Agency (QAA) aims to provide equipment manufacturers with a list of suppliers who can provide acceptable items with minimum delay, the present specification procedure usually shows that manufacturers are overwhelmed a handful of one agency which gives the QFI tests. As a result, QFI has little value to an equipment manufacturer.

He made contact by our tests to determine the present situation and quality of the supplier's current production.

Under the proposed recommendations, equipment manufacturers would be addressed in selecting initial supplies for applications tests. It is required only to provide.

- Evidence of satisfaction, production, test facilities, and normal production quality control practices
- Sufficient test data to produce quantities manufactured over an extended period to establish, within prescribed confidence limits, that the cost

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The G-20 Control Processor, or computer, has a staff of well-taught subordinates that can take instructions from the "boss" and go to work on their own, directing the workers that perform such tasks as reading punched paper tape and cards, looking up data on magnetic tape, and printing results. The "boss" can direct numerous subordinates, and without human intervention, schedule the work for each, making sure the most important work is done first. While the subordinates handle the details, the Control Processor is free to do the all-important computing.

This "organization chart" delegation of authority means several operations may be performed simultaneously, and with a maximum of equipment. The result? Cost is "low cost per operation", or "just plain efficiency", but it is all the same. . . the Bendix G-20 gives you more performance per dollar than any other data processing system. The most performance specifications listed at the right show the tremendous speed and power of the G-20. Comparisons and design are the most modern in the industry today. System sizes can vary from a medium-scale system to a very large system with remote on-line or off-line sub-systems. Write for complete descriptive literature, BENDIX AVIATION CORP., COMPUTER DIVISION, Dept. 205, Los Angeles 45, California.

SPECIFICATIONS

MEMORY: Core, 16,384 words in 4000 word modules.

EXECUTE: 7 μ sec. fixed print, one word per sec.; 13 μ sec. μ sec. floating point, one word per sec.

EXECUTE: 40 μ sec. fixed print, one word per sec.; 49 μ sec. μ sec. floating point, one word per sec.

ARITHMETIC: Shift or floating pt., 12 dec. digits precision
CAPACITY: Subprograms: 1000
Inf.: 25 kba.

PROGRAMMING: Symbolic as well as algebraic computer
INPUT/OUTPUT: 10,000 char./sec. read, synchronous.

MAGNETIC TAPE: 10,000 char. and 4000 words/sec. read/write
LINE PRINTER: 400 lines per hour.

PUNCHED TAPE: 500 or more characters/second read, 150 or more characters/second punch.

PUNCHED CARDS: Two-deck high speed 20 columns on dc.
CONTROL SYSTEM: 1200 characters memory for data and commands. Control program: 10000 lines or off-line.





Strategic Air Command Test Control Bank

Strategic Air Command test control bank (left) part of a prototype system now under development, checks functions of computers and data processing units at Phoenix, N. J. At right is a staff of the prototype automatic control center. Both are being built at Phoenix by International Telephone & Telegraph Co.

ponent's failure rate equals or is better than averages established by specific tests.

• **Qualifying test data**, collected during acceptance tests of subsequent production on a continuing basis, to enable the central agency to determine whether a supplier's components still meet the original failure rate, whether he must furnish testing or can be allowed to a higher reliability level.

• **Notice of change in design** of one part, subunit or process used in its manufacture, to enable the central agency to determine whether a component's reliability schedule being used is re-evaluated.

To reflect the varied nature of qualification approval, it is recommended that the new be changed to "Approved Sources of Supply for Qualified Electronic Items List."

The ad hoc committee report recommends actions which are needed to relieve equipment manufacturers of some of the excessive component testing that now now performs, but are not intended to relieve the equipment manufacturer of the prime responsibility for component quality and reliability. The report acknowledges that it is too expensive for each equipment manufacturer to submit its own inspectors at each of its component supplier's facilities to assure that tests are performed according to specifications and that the test data is accurate.

It is therefore recommended that all military specifications require the component manufacturer to provide test data on parts supplied, with certifi-

cate of such data by a responsible official of the manufacturer.

Increased rate of government inspection at component manufacturer's plants also is recommended. This should be used not only for direct purchases by the government, but also to verify inspection procedures where equipment manufacturers wish to delegate acceptance tests to the government. Government inspectors also would conduct audits of manufacturer's facilities, quality control programs and make spot checks of outgoing product quality to determine compliance with military specifications.

A survey of 15 equipment manufacturer and 20 parts manufacturers by one of the subgroups in the ad hoc committee revealed that both each about 50% of all parts are questioned to verify specifications and that government source inspection is required on approximately 35% of all parts other than those which are subcontracted or which are government-owned. Inspection is mandatory for devices sold to military specifications. The survey indicated "in all most overwhelming response" for the introduction of in-plant quality tests approved testing under the supervision of the government inspector at the point of sale.

Another subgroup of the ad hoc committee recommended the establishment of a central organization in the Defense Department to collect individual information on basic component data on tests and component application data from industry and the military services for dissemination to industry and military designers. Efforts by in-

dustry to exchange such data have not been too effective because of fear of legal entanglements, the report says.

The report questions, however, whether such a central government data exchange agency would greatly reduce the amount of component testing now carried on by individual manufacturers, and whether such manufacturers are willing to participate. For this reason, it calls for an effort to obtain greater standardization of test procedures among defense contractors.

The report also recommends that the military services standardize an integrated base indicator and make it available to manufacturers, where feasible on military electronic equipment.

The report also calls for new standards control programs, supported by computerized techniques, to obtain and analyze failure rate data for typical air, shipboard and ground-based equipment. Further, the data should be compared with that now obtained from Electronic Equipment Field Data Reporting System cards prepared by military maintenance personnel, to determine whether data from two sources can be correlated.

The detailed, five-volume report by the Ad Hoc Study Group on Parts Procurement Management for Reliability, prepared under the sponsorship of the Office of the Director of Defense Research and Engineering and the Office of the Assistant Secretary of Defense (Supply and Logistics) now at being prepared and is expected to become available at the Commerce Department's Office of Technical Services by late June or early July. Price has not been set.

Micromodules Pass Environmental Tests

By Russ Miller

Washington—Petrolog increased the outstanding reliability margin of low-power and current features here successfully without any apparent loss of cost at the Electronic Component Conference.

The initial modules include a micro version of audio video frequency and digital type circuits which were subjected to a series of tests covering environmental which the modules single free to portable ground, vibration, noise or airborne applications. A report devoted to the status of the Aero Signal Corp.-Radio Corp. of America micromodule program, was prepared and presented by Russ Miller, of the Reliability Conference. Director of RCA in Concord, N. J.

The Aero-RCA micromodule program is reported as the most heavily field-tested supported effort to assure manufacturability of components and systems. The Aero's on-subject as the program included in her and 515 modules weekly with an total of 58 million (AW Mar. 2, p. 101).

An equally intensive, the Aero program (AW June 9, 1966, p. 22, Apr. 11, 1966, p. 70) included a limited reduction in the size and weight of military electronic equipment and a compatible logic in reliability and manufacturability.

Strength objectives appear to have been met in multiple circuits similar reliability, and sustained ability gives are somewhat more difficult to measure. The program has triggered, however, a vast effort among manufacturers to design components in suitable form factors for firm and other high component design program now ongoing.

Comparing with RCA's subminiature are also 3000 micro modules which weigh materials and components for the program.

Micromodules, an encapsulated shell of 931 in square wafers on which components, called silicon die, are assembled and they inter connected by 12 wires running through wafers along the edge of the wafers leads from aluminum wires and weight economy. The program aims at a similar miniaturized production and assembly of the modules.

To date the Signal Corp.-RCA effort has concentrated on tactical field equipment such as the AN PRG by a hybrid video frequency module for which a complete micromodules receiver has been developed. A digital data processor or high speed general purpose

digital computer, about two cubic feet in size weighing 35 lb and containing about 2,000 microcircuits of 16-bit digital type, plus a scanner, will be built under the latest handling to demonstrate micromodules capabilities. Separate from the Signal Corps effort another RCA department recently developed an overall guidance system which was micromodules on one aspect of its construction.

Among the events already designed into micromodules are the RI and video portions of a 16-bit FM receiver. These include RF amplifier, mixer, detector, IF amplifier, limiter, discriminator and audio amplifier. Digital outputs—linear driver gate, pulse generator, time modulator, oscillator and pulse shaper, output amplifier—were fabricated for a true 16-bit analog receiver.

Environmental Tests

Environmental tests in which the modules have been exposed include temperature tests from -55 to 55C as well as vibration, altitude, shock, sea storage, salt atmosphere and moisture resistance checks, according to Miller.

Reliability of the module circuit has been comparable to that of our traditionally constructed circuits. No fundamental construction, Mikes and zinc, was introduced in connecting sites of the program, maintained in this into micromodule form.

Among the micro elements—single or multiple components mounted on a single carrier—which have been developed in various forms for the program are the following are mentioned by Miller.

• **Resistor-Potentiometer** resistor (tolerance to within 1%) ranging in value from 10 ohms to 10 megohms, with up to five (center-dependent metal) dimensions also used as a single substrate, also made by Weston Instruments Division of DuPont.

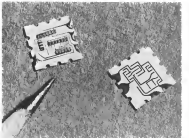
• **Inductor-Wound** in different types of ferrite cores, these inductors are available for inductance values below and above 1000 ohms coupling to adjacent elements. Values up to 1,500 microhenries have been demonstrated. Products manufactured by 50-ohm RI cores, 4.5-ohm, 10-ohm and 100-ohm coils for Eltron was fabricated.

• **Diodes-A** family of Zener and reference diodes and multi-use applications of IN401 defined silicon junction diodes manufactured and IN277 gold bond General Instruments diodes were made available.

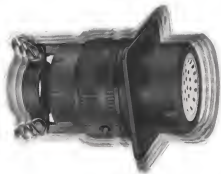
• **Capacitor-S** 70-pF with 50% spread.

• **Transistor-RCA** processes 2N146 (NPN) and 2N151 and PNP 2N102A were developed for this program.

• **Capacitor-L** one type of capacitor was prepared by several firms. P. R. Miller, Space Electric and RCA among them. Capacitors include test tubes developed in video products up



ABILITY of Aero-RCA micromodules under to physically accommodate miniature test setups is illustrated by the bond wire using direct bonded eutectic tin-lead mounted on a single module carrier. Shot at right is covered in second order. Work was done by Sorell Research Center under contract to Air Force Cambridge Research Center.



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to 40 standard volt inches, the voltage rating can be tickled during manufacturing, multi-layer ceramic capacitors of different types.

Next step is solderable progress will be the inclusion of several unique parts as a single solder, already first contained in principle with ceramic dip-soldering material and a few other solderless wires.

Microstream Techniques

Various solid-state or radioactive systems are expected eventually to fit into the microstream approach. These microstream techniques are comparable either from competitive with micro-modules, Miskin believes. The micro-module can be the vehicle for these techniques, he says, because they lead themselves to the five-fold form factor of the micro element. Some of these solid-state devices have already been mounted on single wires to demonstrate the module capability. On one wire, for example, RCA engineers placed a full order allowing resistor function and the integrated device concept of J. F. Wilbur of RCA Laboratories, Princeton, N. J.

This single integrated circuit performs the function that is normally accomplished by 88 conventional components.

Transition to these new techniques and problems associated with their development and solution, will take time to economic and in the external module frame design will probably exist in hybrid combinations with conventional components, Maday suggests. Solutions to specific circuit or system problems may involve an overlapping of several techniques, he points out, each superior to the other in some characteristic or application. In time, the single component wire structure, now generally characteristic of early systems data, will give way to multi-layered wire modules whose functional capability is increased but whose appearance will be unchanged.

The first issue question status reports on the progress of the micro-module program, dating back the period up to the first of this year, are now available from the Office of Technical Services, Department of Commerce, and an eighth report covering the first quarter of this year is expected to be available shortly.

A byproduct of this program is the continuing trend toward repackaging standard functions into smaller cases (ED, Apr. 11, p. 94) so that the transition is smoother, especially in height do not consume excessive space in an attempt for packaging components and interconnections.

One component packaging approach involving a smaller RCA 7N106 circuit for interconnections was described

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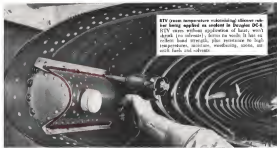
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Prepacks for engine nose cone (right) cast in RTV mold. Epoxy parts cast in flexible RTV mold have a bright glass surface and separate extremely fast detail. No gassing agent is required for most nonplastic parts. High tensile and tear strength is retained even after prolonged heat aging.



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by Marley. The transistor package is exploded, sets a recessed high density aluminum substrate with holes for the connector pins at the bottom of the recess. Solder coated wafers are pressed to form metal contacts through conductor paths on the outer surface of the case. The transistor is dropped into the recess, its leads welded to the connectors and a second lid is soldered to a ring which has previously been placed around the recess to establish a hermetic enclosure. Ultrasonic energy does the cleaning, making solder flow unnecessary.

Phenol Transistor Package

In another report at the conference, F. K. Clarke of Philips Lonsdale Tube Division reported on Philips' atmosphere transistor package, which is designed to be suitable for solder attachment and an encapsulable surface. The package, Clarke says, can be inserted into a slot in the wafer and its leads will protrude hermetically, parallel to the wafer face, in its original configuration in other components on the wafer. General discussion of the Phenol package, as previously reported (AVY, Apr. 11, p. 94), are 180 mils in length, 115 mils width and 60 mils high.

In the Phenol package a layer of glass separates a metal base plate and a rounded rectangular cap. Electrical connections to the semiconductor, Clarke explains, are provided by strips of metal, 100 mils thick, which are embedded in the glass. A top plate is then soldered to the package flange to hermetically seal the device.

Steps in the fabrication of the package described by Clarke are as follows:

- Glass tube of the base and lower side of the cap are glass-cast.
- These flat leads are bonded between the base and cap.
- Encaps material is trimmed.
- Semiconductor is mounted in the package and the top plate is cold welded to the flange.

Members of other silicon manufacturers are expected to reveal their approaches to the smaller transistor package during the remaining months of this year. Systems, for one, is understood to be on the verge of producing its government thin gap transistor in a quartz-mineral package package, 120 mils in diameter and 50 mils tall. Contrasted with the Siliconix flat package dimensions are those of the "small" conventional TO-6 one registered with the Electronic Industries Assoc. at 170 to 193 mils in length, 200 mils in diameter.

Siliconix now designs electrical equivalents of its pass drift transistors, open collector transistors, and silicon base germanium and silicon mesa transistors with its new 301 package.

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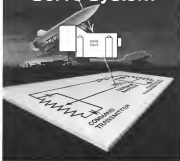
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- 4:1 or 10:1
- 4:1 or 10:1



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• **Galileo Airside Transducer**—Developmental model of a drift field transducer made of galileo ceramic, one of the premier piezoelectric materials in the piezoelectric component family, was demonstrated by RCA at the National Aeronautics Electronic Conference. This transducer differs from other devices in its ability to operate at elevated temperatures—above 275°C. It has a large 50 milli-ohm current and has an output current frequency of 100 cps. Earlier RCA galileo airside transducer were described in a talk before last year's IEEE Convention by William Webster, now head of RCA's Electronics Laboratory in Princeton. Commercial models will be available within a few weeks. CEN-5049-3-65.

• **High Temperature Seaconductor**—Scientists at Bell Telephone Laboratories are investigating that studies of the properties of—and crystal growing techniques for—galileo phosphate, another intrinsically piezoelectric crystal whose growth for high temperature seaconductor devices. Doped and alloyed germanium diodes with breakdown voltages up to 55 v, rectification ratios as high as 1 million and the ability to operate up to 500°C were fabricated by C. J. Foy and M. C. Conner at Bell Labs in Murray Hill. Transparent quality of galileo phosphate makes possible visual studies of the effects of varied doping levels. Galileo phosphate diodes were also fabricated at the U. S. Army Signal Research and Development Laboratory (AW Dec. 21, p. 67).

• **Cooling Transistors**—Thermocouples which spot cooling of transistors will be commercially available in late June from the newly-formed General Thermoelectric Corp., Princeton, N. J. Company says it will generate silicon transistor arrays of up to 1,000 per sq. cm with hot junction at 350°C for both p and n types and a bimetallic thermocouple built-in doped with silicon and selenium.

NEW AVIONIC PRODUCTS

Components & Devices

• **Resistors**, wire wound type PMS, are bare mounted with two parallel leads and require an area only in their construction for mounting. Because ceramic protects elements from mechanical loss, negligible environmental conditions. Resistors are available in four power ratings—1, 1/2, 1 and 10 watts—in 5 mm ranging from 1/4 to 100,000 Ω. Resistances range from 0.05



to 175K ohms and tolerances run 0.05, 0.1, 0.25, 0.5, 1 and 5%. Our type provides full power up to 100°C others to 250°C and all are then devoted to zero impedance at 275°C. Doh Products, Inc., Box 136, Columbus, Neb.



• **Resistor plug sockets** are available in 8 sizes ranging from 0.01 to 7 mm diameter with power ratings from 1/4 to 2 watts. Tolerances are 1% through 0.05% standard. Resistor plug sockets are 1 in. and 1/2 in. and others can be ordered. Resistors cost about \$2.00 each on 0.1% tolerance and lots of 100. Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.

• **Frequency standard**, Type L, a solid state crystal oscillator, provides a secondary frequency source of 400 cps. The unit weighs 4 1/2 ounces and contains 100% tin, case silicon transistor throughout and a available with spare wire as standard output. It operates from 400 millivolts over range from —55 to 100°C and the output is



AVIATION WRECK, May 14, 1960

and output 0.015V. Designed for Induct, Inc., 6341 Fulton Pkwy., Cleveland 9, Ohio.



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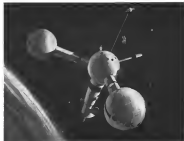
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ADVANCED MODULAR design for earth-orbiting space station proposed by Lockheed Martin and Space Division scientists, will be assembled in space and orbit the earth at 310 mi. Station would consist of prefabricated parts connected into orbit.

Space Pilots Show Superior Capabilities

By Richard Swearey



STEREOSCOPIC EFFECT may make manned space station to retire early. Station could be expanded by adding modules only as desired to carry out experiments not possible on earth. Assembly would be made by a low-cost "orbiting" ring mechanism seen

Los Angeles—Pilots, using control systems and displays designed to make the most of their capabilities, not only will be an important part of forthcoming space stations but a number of conditions will be far superior to automatic flight control systems in performance, according to reports presented at the Manned Space Stations Symposium here.

Simulator activities and simulator demonstrations which indicated the men where the best results are obtained using a pilot supported the report.

One view, according to Eugene Levin of Rand Corp. and Jack W. Ward of Spence Technology Laboratories, is on the docking phase of an orbital mission. A device to provide a simulation of the essential features of the problem, utilizing an analog computer, was set up at Rand and a group of subjects worked space vehicle docking problems on it. Subjects included both pilots and nonpilots.

The display provided overall situational and orientational information on

an oscilloscope while detailed quantitative information was supplied on a group of dials. The subjects assessed distance, rotation in coplanar orbits by an intercepting vehicle, and a landing.

The oscilloscope presentation could be done also representing the target vehicle, the other the intercepting vehicle. From the intercepting vehicle, a light line indicated the velocity vector, the length being proportional to speed, while the direction is shown by the line's angle with respect to a horizontal and target.

Thrust Controls

Two levels of thrust controls were provided, an all-outward operating discrete levels of thrust in conventional astronomical (normal) speed (also at downward angle). The second control system was a continuous stick which applied variable levels of thrust in desired directions, with the amount of stick displacement indicating the quantity of thrust which, direction of displacement indicated thrust direction.

Findings were, according to the report, that the docking maneuver could be performed with great precision using unassisted precision-aid velocity data whenever less than two feet of separation and about 1/100 g's in velocity difference.

In cases where the docking phase was accomplished starting from a position less than a mile separation and relative velocity speeds of a few feet per second, it was found that a "braked good" docking was done in a small fraction of one orbit cycle with an expenditure of 30-35 g's in clearance to velocity.

Experimenters were run in conditions of reduced information inputs, and trained pilots still were able to achieve



THREE MONTHS of the modular space station set shown after being assembled by an "orbiting." A light line will be caused by slowly opening the station along its longitudinal axis.

docking with good efficiency. In another experiment, using trained pilots, the target station was represented on a plotter by a beam (angle/size), and pilot thrust indicated plots could be to intercept vehicle through the center.

Other phases of the intercept, the launch and detrain closing, showed varied results in the photo-automatic flight control system effectiveness.

In launch phase, automatic flight control system had a clear advantage in efficiency, while in the detrain closing phase, there were conditions in which pilot efficiency approached that of the automatic flight control system in terms of fuel consumed.

Military Space Test Station

Los Angeles—A military space test station for scientific research and military tests will be the next logical step of the USAP as an evolution of aerospace vehicles, according to Col. Lowell B. Smith, chief of the Space Station Office of Wright Air Development Division, AFDC.

A station for a collection of fundamental scientific data would be rapidly followed with the addition of military tests and detection of the effects of space reaction upon people, machines and weapons. Col. Smith indicated: "Acquisition of knowledge about space as an environment for military operations is essential, but not always done in overlap between pure scientific research and military research and development test."

With military and civilian activities participating in a equal as a joint endeavor, the entire spectrum of basic research will be investigated with absolute practicality and life sciences as the scientific research work.

In military testing, nuclear rockets can be tested without contaminating the atmosphere, engine tests in vacuum can be accomplished and guidance equipment for space-to-earth rockets can be tested and developed. The station can also serve for weapons system checkout, a training site for space crews and for the study of meteorology.

Development and operation of the station was seen as feasible in the early 1970 time period, with test areas including a life science laboratory, a orbital observation area, a propulsion test area, economic test area and public launching stations.

An automatic flight control system for a manned space vehicle, which can maintain attitude changes during reentry according to data supplied directly from a six temperature zero-of-change feedback loop, was outlined by J. Stoklos, Dorrville and D. Irwin of Hughes Aircraft Co.

Hughes' Design

Extending the investigation, the Hughes station design philosophy called for changing attitude as the roll axis as well as pitch with the combination of temperature rate-of-change and roll pitch attitude variations acting to structure aerodynamic heating in re-entry and provide a wide margin of safety control in the descent.

The Hughes approach was two-phase theory—that is, long the period descent as a re-entry with the greatest altitude, lift will increase, acceleration heating, and effective re-entry, at velocity higher than the local circular velocity results in lower maximum heat penetration.

The station operators to establish a vehicle pitch attitude prior to starting reentry, which gives the highest available angle of attack during part of re-entry, the temperature rate of change increases, causing by a change of attitude which will give more lift.

However, the trim limits on the vehicle hold the angle to that already established.

Further along the trajectory, as the air gets denser, the combination of aerodynamic forces from sideways and zero decrease will become greater than weight and the vehicle starts to slip back up

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out of the atmosphere, still in a "near vertical pitch angle."

At the vehicle bottom and starts its own pull-up, the dia temperature rate of change remains stiff and steady throughout. This commands a decrease in vertical lift (41) and the decrease prevents the vehicle from skipping out of the atmosphere again.

In closing the decrease in lift, after the pitch angle can be varied or the lift vector changed by entering the vehicle in the 40 sec. Data from the dia temperature rate of change feedback loop can either move the elevation of the altitude, or a combination of both, with the combination providing range flexibility.

Using the bank, bank, maneuvering capability lateral to the plane of the orbit is achieved as well.

Analogue Simulation

A complete analog simulation was run by Hughes using a vehicle with a weight representing 17,500 lb. at velocity and starting from a 300 knot air orbit which is left by a single retro decelerating rocket stage.

The vehicle has 1,000 sq. ft. of wing area and two diameters of 111 sq. ft. each and landing bodies with 15 sq. ft. of area each. One clover and ring rudders are used on each side of the vehicle, which is shaped like an arrowhead, is 75 ft. x 40 long and 44.82 in. wide and has a zero cross-section chord of 20.5 in.

Maximum design angle of attack was 45 deg., which provided a lift ratio of one to four, and vehicle velocity from 18,000 ft. per sec. to altitude of 60,000 ft. where the atmosphere flight control system was considered to become operative, down to 4,300 ft. at 10 sec. altitude. Initial re-entry angle (at the 60 sec. point) as well as the 160 knot air speed) of 1.5 deg. below the local horizontal was used.

Range Control

Using these parameters and with a catalytic heat disposal concept, the control system provided range control from 4,700 knot on down from the start of re-entry to an approximate 1,000 knot on. The vehicle also kept the maximum heat inputs relatively low, since the vehicle did not slip out of the atmosphere control, maximum lift angle of attack, was kept and the lift vector varied by changing bank angle instead of pitch angle at banking rate of change increased.

The Hughes parameters also suggested a control system for space flight, which would be suitable in the descent approach as well as docking phases of the advancing vehicle concept.

In both space and atmosphere control systems, manual pilot mode was included, and all simulations showed the

pilot was fully capable of handling the vehicle throughout the entire performance envelope reported.

Proceeding from Project Mercury, future planning logically would include multi-man orbital vehicles, multi-man atmospheric flight, manned lunar exploration and eventual interplanetary exploration.

Probable Order

The probable order of advancement was outlined by Robert Colwell and Earl Stott of National Aeronautics and Space Administration's Space Task Force, as their presentation to the aerospace.

Considering the factors involved, early man earth capability should be achievable within the expected state of the art, and from there might logically be directed to manned reconnaissance vehicles if enough time would pass to avoid difficult problems. The manned lunar

landing and return should not be directly pursued at this time, according to the report.

While the design to which space vehicles can be altered to check landing rates on earth after return from a mission is not yet clearly established, various possibilities are being studied. The quantity and quality of guidance, control and propulsion is required during the various phases of the flight which will be available will significantly affect the degree of landing site factors. Some critical reentry shapes which control flaps or lifting bodies appear most desirable with steady requirements dictated by energy speed, thrust, report load, and stress or structural requirements are possibilities for final design.

Orbital reentry control is implicit in manned flight, the report stated, and even in the Mercury system, structural selection is complexity of the



Aeronastronics Envisions Lunar Impact Vehicle

Project Ranger land impact space vehicle announced by Aeronastronics Division of Ford Motor Co. has been proposed to NASA's Jet Propulsion Laboratory (JPL May 21, p. 26). Vehicle is designed to prevent an instrumentation capsule from falling prior to the impact, it would be slowed by retro-rockets. After launch, Ranger would orbit earth on two days to collect solar energy and point its instruments to earth for radio guidance commands to Ranger soon coast, it would take television pictures.

The important advances in environmental testing come from MB



NEW line of MB hydraulic shaker systems to broaden scope of vibration/shock/fatigue testing



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equal requirements could have been achieved had the usual strengthened airplane-type approach been possible. "That is one increased space station design concept which has emerged from studies by several groups, the report noted, which appears attractive because of low costs and costs of air during flight endurance. This is the modular concept, which is illustrated by the use of our booster type to carry several types of payloads, as is planned for Satex.

Under this concept, for a multi-man vehicle, one module would serve as the launch and recovery vehicle as well as space flight mission control center should a long time in orbit be extended versus be planned, additional modules to meet the added requirements could

Orbital Solar Observatory

Los Angeles—National Aeronautics and Space Administration hopes to launch an orbiting solar observatory late this year which will be installed in space earlier than is reported to the earth by Nancy G. Roman, head of NASA's Observational Astronomy Program, told the Mission Space Station Symposium here.

The observation system will allow approximately 150 lb of instrumented instrumentation to remain pointing at the sun with an accuracy of one minute of arc. The instrumentation will be designed to obtain detailed spectra of the sun in the soft X-ray and far ultraviolet wavelengths and measure and measure the X to gamma rays from the sun.

In about three years, Dr. Roman said, a large satellite will receive more advanced instrumentation for similar purposes and provide instrumentation for the viewing range of the sun in the far ultraviolet by studying solar coronae in wavelengths and rays from the earth's surface, and by studying the sun in wavelengths not previously observed.

The satellite also will be instrumented to study the earth's upper atmosphere and cosmic-ray spectra, with provision attention to be paid those phenomena believed to depend on solar radiation.

Another project selected for flight is also about three years, Dr. Roman said, is an orbiting astronomical telescope which will be part of an orbiting astronomical observatory. Installation of this satellite will permit the telescope to star pointed at a particular star within a fraction of a second of one to two periods of up to one hour, and provision will be included for selecting the scope from one star to another by control from the ground. This report was first announced last year (AVR June 15, 1956, p. 32).

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NEW MISSILE AIR CONDITIONER for ground support



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This new ground support air conditioning package by Stratos provides a cooling capacity of 20,000 BTU/hour when equipped with its 3 hp 7.500 rpm motor compressor unit—and 30,000 BTU/hour with its 10 hp 17,500 rpm unit. Weighing only 300 pounds complete, measuring just 42" x 24" x 48", and rated at 2.2 to 4.2 tons, the Model VEEA-3 air conditioner simply demonstrates the high capacity that can be achieved in a compact package—due to Stratos' unique High Pressure compressor and efficient evaporator and condenser. The rugged VEEA-3 was tested military specifications.

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TIROS WEATHER SATELLITE IN ORBIT

Allied Research Systems Key To Interpretation

With the launching of TIROS, the United States makes a significant contribution to world meteorology. Satellite-instrumented satellites are being studied for potentially useful weather forecasting information by scientists from key governmental activities and Allied Research.

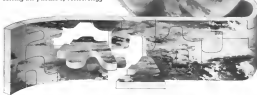
Allied Research assisted in building personnel at the data gathering stations which transmit satellite data with photographic prints to ships with problems posed by the spin and orbital motion of the satellite and by the curvature and rotation of the earth. In this procedure scientists employ methods developed by Allied Research.

Meteorological interpretation and techniques for transmission of TIROS data are other areas in which Allied Research contributes.

Creative scientists at Allied Research are probing many new areas of meteorology, studying infrared satellite observations, upper atmosphere soundings and radar surveillance.

Characteristically, Allied Research works on the location of knowledge and would welcome inquiries from well-qualified technical people who wish to join its expanding team. Contact Personnel Manager, Allied Research Associates, Incorporated, 43 Leim Street, Room 105, Maui.

Solving the puzzles of Meteorology



Allied Research work done under contract to Geophysical Research Directorate of the Air Force Cambridge Research Center. TIROS project sponsored by NASA.



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be attached like balloons on a line. The balloon could be colored to flight by the crew, but would not have to inflate or have any escape provisions, and also could hold additional equipment pertinent to the given mission.

Several examples of orbital maneuver design were presented at the meeting, with various approaches to clearance, fabrication, assembly location, coupling limits, a single unit as proposed in a report by Martin Co. (Aerospace JAW Apr 25, p. 7), to a modular assembly envisioned by Lockheed Martin and Space Division's Saunders & Kaiser and Richard A. Byers.

Significant Variables

In a discussion of factors affecting selection of a mission space station concept, Joseph H. Jones and Lee J. Montague of Boeing Airplane Co. chose weight, time and money as the most significant variables.

A basic choice they indicated, was whether to manufacture the entire station on earth or to assemble modules in orbit. In view of present U. S. booster development plans their conclusion supported the NVA's idea of modular assembly in space, with the modules manufactured on earth and made as large as booster capability permits.

With a 1.5 million lb thrust booster and high strength upper stage, a payload weight (excluding) of 10,000 lb could be placed in a 300 mi orbit. A very important aspect of the booster which affects the cost-weight ratio was providing for recovery and reuse of three boosters.

Self-Contained

The concept of Krueger and Byers, based on a two-stage, expendable form of the concept of autonomous over the next 10 years, had each module as a self-contained vehicle. This way, crew survival problems are reduced, they said, and also assembly complexity which poses a major problem in space, generally were included at minimum technical obsolescence cost.

Two module shapes were proposed: 10-ft-dia cylinders 10 ft long and 14 ft dia spheres. The first station would consist of two cylinders with a sphere at each end.

Station orbit altitude is below the Van Allen radiation belt, yet as high as possible to reduce atmospheric drag. Provision for affecting orbit decay are included.

An artificial lg gravity force is provided by rotating the station about its central axis.

Along with the modular space station concept, the presentation proposed two vehicles—an "astrocruiser," and "starship." The cruiser is the res-



First Static Firing of Eight Saturn Engines

Successful first static firing of all eight engines of Saturn space vehicle booster (SVB) May 8, p. 19, conducted at Huntsville, Ala. Used eight assemblies and developed about 1,300,000 lb thrust. Full duration firing of engine, which will last 120 sec, at full throttle properly, is planned for June. Tests are taken from testhouse, 1,000 ft. from test tower.

design and re-orient vehicle for crew change and swapout and additional burn time while the tug is a safety moor which stays with the station in orbit.

Structural proposals and approaches outlined at the session included inflatable-orbital lockers, as well as standard assemblies, plus mechanisms on orbits of reduction in structural, reduced impact and unspinning, the use of coupling in space, structures and using the structure to provide a significant degree of thermal control for the vehicle.

Double Shell

Using a double shell with the proper radial members to provide required additional strength at high and low temperature extremes was proposed by Peter L. Glass of Arthur D. Little, Inc.

An automatic control system would regulate gas flow into individual panels of the cyclic structure according to thermal requirements for the cabin and occupants while in orbit. The gas used in orbit would possibly be delivered from the fuel used in ascent and reentry, since the combination of gas, oxidation material and temperature re-

quired in these cases would have to meet different strength and thermal protection requirements than the orbit condition.

Dual-Fuel Reactor

A rotating dual-fuel, dual-mode reactor to provide electrical power to orbit was outlined by W. R. Corbin of the Martin Co. Power advantages, Corbin said, are use of spare equipment and sections of liquid cell gases in working fuels and heat transfer agents.

Uranium carbide or plutonium carbide fuel would react in a contact peak with the fuel oxidant that continuously. A neutron reflector to generate fission would be incorporated on one section of the tank, while past beyond it there would be a section of fissionless power generators to convert part of the heat to power, while the remainder of the heat is isolated back to space.

Prediction of large quantities of power is inherent in the concept, to effect the station sought, according to the report, which also acknowledged that certain areas of the concept need considerable research and development effort.

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movable, standard, 14-day scientific laboratory was processed by J. W. Binkaus and D. M. White of Chance Vought Aircraft, Inc. They concluded that the design and fabrication of such a valve is feasible today.

Three-Max Crew

The three-max crew for a 14-day orbit was selected as a crew between the citizens (two men for five days, or five men for 50 days) which appear to encourage the usage of parabolism for several generations ahead of space, in time.

Complexity was emphasized to reduce the chances of high reliability and maintain structural weight. In addition, a simple design would be sought to reduce the vehicle cost. Light weight is considered of prime importance because it permits large external loads and more growth potential.

The fabrication would be a cylinder 81 in. in diameter and 16 ft in length. It could be one of several modules which could be re-supplied and connected in space. Total weight would be approximately 5,800 lb. For a 14-day, rather than a 14-day mission, the diameter would increase to 105 in. and overall weight to more than 10,000 lb., due mainly to the increased weight of the electrical power supply and communications equipment.

In another talk Kenneth F. Hoggland, of General Astronautics, had a varied, severable bond will ensure the largest degree of modularity over the mission to limit the extent of the necessity for a recovery landing. Design is for surface impact loads and the possible attachment with salt water recovery sea.

Winged Booster

Some wings represent a considerable addition of weight, additional thrust must be provided to maintain performance, a lack of time requires additional propellant and propellant tankage. The result of providing recoverability is that a first stage winged booster would necessarily be about 60% greater in size and weight than an expendable first stage booster.

However, Hoggland agrees that the winged booster will be more economical for high launch rates.

Booster mission, in size by Hoggland, is substantially of a payload of 100 tons or less using solid. The first stage boosters point at between 250,000 and 400,000 ft at a velocity of 8,000 to 14,000 ft/s.

The entire vehicle, including payload and booster, then has a vertical lift-off along a zero lift or ballistic trajectory to first stage separation. At launch, external thrust loads are created by booster engine thrust loading providing transient loads in the propellant which

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Internal Systems Installed in Mercury Capsule

Selection for Project Mercury spacecraft capsule are installed in the spinless nose of McDonnell North Cap (AW No. 2, p. 20), note other motion were by techniques to aid dual collection possibility. Data storage capsule also has not yet been installed.

they are at maximum volume.

Catastrophic flight loads occur during the launch phase and usually occur at the time of maximum dynamic pressure. At this time the maximum of the combined bending moment, axial acceleration and drag loads, and shear loads occur on the fuselage.

After separation of the upper stage and payload from the winged test stage, the winged booster is impacted and crashes on a ballistic flight path to impact.

The loads that occur during the ground air test, due to the absence of structure and have no critical design effect upon the airframe.

Critical Phase

First stage, the most critical phase of flight begins—re-entry. The critical period of re-entry for the winged booster also is ballistic, since in this flight regime weight is greater than lift, plus centrifugal force.

An atmospheric density increases to de aerodynamic temperature and loads. Due to the high angle of attack attitude of the winged booster and its high velocity, the lifting forces are maximum for the whole re-entry.

In addition the magnitude of the

re-entry, aerodynamic forces combined with lift due to positive pressure on the lower surface and drag, occur on the aft fuselage combination in which flight rigging and structure become the limiting conditions.

The remaining portion of the mission profile, the cruise to launch and landing, does not present any unique loading conditions except perhaps low loads on the ground.

Design Problems

The problem of evaluating aerodynamic loads of a winged booster are difficult compared with a conventional aircraft because of its size in relation to its loading conditions and the environment in which it must operate. Its smaller comparison the elastic or expendable booster is short-lived, while a winged booster airframe must be designed for a long service life. Therefore, a winged booster must exhibit the modulus properties of an airplane while operating in the stresses of a quick re-entry.

Hopfield suggested that winged boosters subjected to relatively high transients, such as landing edges will be designed for a hatched metal lift and to applicable.

Mice Deliver Young in 2g Environment

Litters of mice have been conceived, delivered and raised in a centrifuge which twice the pull of earth's gravity, and other mice have grown in a centrifuge for a year at 7g. State University of Iowa researchers have reported.

Dr. Charles Wessley, assistant professor of physiology, and graduate student Anne Steuber Baines reported that the mice do not eat as much food as usual when they first go into the centrifuge and that they decrease in size. After a few days they begin to eat more and gain back some of the lost mass. Within two weeks they are larger than before the start of the experiment. They continue to gain but never attain the size of normal or controlled animals. Baines appear to grow faster than other parts of the research.

Primary purpose of the air and model test program supported in part by the Public Health Service and the American Council Society, is to study factors that control growth.

Master believes the findings will be important in research upon flight or space.

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Bases such as this cannot be built overnight. It is a credit to the foresight of our military planners that the bases will be operational concurrent with the new ICBMs now in production at Martin-Denver and undergoing advanced tests at Cape Canaveral.

MARTIN





First photographs of AN/US-11 show French-designed anti-tank missile on 100-ft-long trailer. (Data stopped does will see Pratt & Whitney's



HQ 5-16 (Q1 12) (rocket engine). Marlin's Lucas mounted guided track, mounted on launcher, is a strip weapon for close support



Army Stresses Mobility, Firepower in Weapon

New weapon display at Fort Benning shows Nike Hercules in the foreground, with mobility of new Nike Zeus behind it, followed by Hawk missile, Honest John, Lacrosse and Corporal



New America's US-11 anti-tank missile can be fired from light helicopters



Smaller Nord 26-70 French-designed anti-tank missile are shown in U. S. Army financing rig installed on back of 1-ton vehicle

Demonstration

Extreme mobility, massive firepower and improved surveillance and communications were the characteristics stressed by the Army in its parade of new weapons during recent project MAN demonstration at Ft. Benning. (See GVN May 9, p. 10)

The new weapons, some of which are still in the development stage, were shown in static displays and demonstrated in live firing. Most of the weapons are designed to be moved easily and quickly by helicopter, truck or man. At right French Hispano-Lacrosse watches French-made or new transport vehicles (center). Army's new Dingo Crocodile weapon system (below), will have nuclear capability.





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BAC is now off and running with its new Hound Dog missile. With the superpower GAM-77 missile, the B-52 bomber can more easily hurdle ground defenses on the way to a target. In the short span of just 30 minutes, the Hound Dog air-to-surface missile goes from the drawing board to a general account of BAC's inherent form.

Blowing enemy ground defenses while the bomber ship speeds on toward the main target is just one of the jobs of the versatile GAM-77 missile. Slung beneath the swept-back wings of a B-52, a pair of GAM-77's can either clear a path for the bomber, or be sent right in on the main target itself. This triple-threat capability lets a single B-52 accomplish a target approach corridor over a thousand miles wide.

To further confuse the enemy, these carefully guided missiles can first attack pre-emptively before banking toward their main objectives. Speed and altitude variations can also be programmed into the GAM-77's target approach.

The Hound Dog missile greatly extends the useful life and striking power of BAC's B-52 bombers—the backbone of America's strategic power. The GAM-77 is being produced by the Missile Division of North American Aviation.

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Navy Project Hydra Demonstrates Water Surface Launch Possibility

By Mags, Calif.—Concept of Project Hydra, Navy's proposed to launch large solid propellant nuclear space vehicles from the surface of the sea, has been demonstrated here with a 6 ft., 150-lb. wooden vehicle powered by a 7.7-lb. Atomic rocket.

Chief engineers of the launch is the Navy desires to promote interest in the project, on the opinion of military and civilian observers at the demonstration. The concept of Hydra is expected to be among strong interest among space program officials.

Navy shortly will launch a larger stage powered by a cluster of Sparrow solid propellant rockets. Hydra is being conducted by Lt. Col. J. E. Dwyer and Lt. C. E. Skelton, of Pacific Missile Range Administration.

Navy is quickly engineering the intricate problem of handling large vehicles at sea but the Hydra program is almost certain to conflict with the Defense Department order suspending booster development in 1949. The ability to launch from virtually any latitude without a large, on-orbit launch pad and other facilities is one of the key advantages chosen for Hydra and this is well with the Pacific Missile Range practice of using shipboard and mobile launchers to avoid dynamic loading, rocket sea sickness ailments and disruption of facilities.

The Rocket successfully launched liquid propellant models testing in the

sea in World War II. The Russians are reported to be working on an advanced form of the German rocket. Navy contribution is the adoption of solid propellants and the proposal that the concept be used to launch space vehicles of virtually unlimited size.

Navy says Hydra can be used between 1960 and 1975 when nuclear propellants should be ready. Navy officials feel that the Hydra air launching technique will start to work with nuclear rockets. For the more immediate future, they are testing vehicles such as NASA's Scout could be adapted for Hydra-type launching at a low cost.

They point out that the ratio of solid propellant rocket specific gravity to that of sea water ranges from 1.0 to 1.40. This would indicate that a booster jacket on upper stages would be adequate modification for a rocket-like Scout. Another solution would be a small flotation ring left on the surface of the sea. For a new vehicle, basic design might incorporate somewhat more buoyancy than that of present rockets. This could be done by increasing the size of the hollow charge port in the craters of the grain.

Solid propellant rocket motors in trucks for air launch are customarily used by a shipboard crane to lower a stowage pressure into when the igniter fuse and to cut down deterioration of the propellant surface. The sea is an



Hound Dog Undergoes Environmental Tests

USAF North American GAM-77 Hound Dog missile undergoes simulated weather tests at Eglin AFB, Fla., before check is made above to temperature ranges from -60° to 160°

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weight and watertight as no sea-tight spaces are needed for ignition below the air sea interface. After ignition, a minimum diameter to nozzle exit pressure ratio of 3.5 to 4 is needed to permit supersonic flow. Given an internal burning pressure of 1,000 psi, a solid propellant rocket nozzle could function as deep as 650 ft below the surface of the sea. Navy specialists call the energy loss to water friction negligible—equal to the work expended in lifting a 17½ in., 916,000 lb. vehicle 11 ft.

- Launch of the wooden vehicle has shown that
- Underwater ignition of a solid propellant rocket designed for air operation poses no difficult problems
- No water instability is produced by the rocket exhaust
- Separation exhaust is not choked by the inertia of water



Hughes Displays Air-to-Air Guided Missiles

Five air-to-air guided missiles manufactured by USAF's Hughes Aircraft Co. are displayed above. GAR-14 solar guided missile is at right, adjacent to the GAR-44 infrared missile. In the row are the GAR-32 (night) and GAR-16. In the background is the GAR-11 surface fighter, the first air-to-air guided missile with wireless capability (AVF May 8, p. 11). GAR-16 and -44 have Mach 2 launch speed, high level of accuracy and ability to escape enemy defenses.

• Water does erode and stabilize reliable designed rockets at the same way that it stabilizes sea waves long used by ancient. Demonstration launch was successful in 30 lb weight with gain to 90 lb and a heavy sea wave.

Disadvantages exceeded are incorporation of liquid propellant rockets with the above instruments and difficulty of access to lower stages when the rocket is in the water. The latter problem could be simplified by keeping most of the instrumentation stages in the top stage.

This could be tested and checked out ahead ship and installed just before launch in a special vessel, probably a small submarine which would be used over the floating launch and attached to it to characterize relative motion during the launching of the top stage.

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United Plans New Jet Orders in 1963-65

New York—United Air Lines looks to the 1963-65 period as the most likely time for any new round of jet transport orders, judging from the forecasts made by its president, W. A. Patterson, to the New York Society of Security Analysts here.

United's current jet orders were based on an overall transportation forecast in which gross national product and population factors were analyzed. The forecast then was broken down by type and it was estimated total domestic jet traffic by 1965 would be 45 billion passenger miles, that overall air traffic will grow 5% annually during this period and that United's traffic would grow 9.7% annually.

Living out the frequency of service needed—United aims at doing 19.5% of the overall transportation business—means the backbone line factor for the jet and other factors, United then ordered aircraft to fit that pattern for each year.

"If we are one of the 45 billion forecast," Patterson said, "then we are ordered. But one 45 billion is the most conservative in the airline business. Our own forecast shows we can be short of airplanes by 1963-65."

Patterson also noted that present orders easy through 1962 in contrast to an intense forecasting phase. When decisions are made for equipment in the 1963-65 period, he said, the forecasting will depend on conditions encountered then.

United had Douglas DC-7s in service and deliveries of 18 Boeing 720s are beginning. Patterson's description of DC-7 transition problems—especially cases of small, expensive parts in hydraulic units growing a small number of dollars annually—exposed these of other operators. The 720 transition should be less difficult, particularly in respect to training where delays occurred in the DC-4 introduction because of incompatibility with the aircraft's loading requirements, Patterson said.

The Sud Caravelle, United's third jet transport type in order, was on United's jet planning list eight years ago as a 90-passenger plane. Patterson added that was announced at that time as a turboprop. After seeing the pure jet, United dropped all thought of propeller since it believed the public would react on transportation by transport.

The DC-7 provides a long haul, high density market aircraft. The 720 fills the shorter range but still high density markets. Lastly the Caravelle fits the lower density market where a 720 might

be able to cover all the passenger generated in one day, but where low aircraft was needed a day to produce the number of passengers. Next, Patterson said, the smaller Caravelle can be operated more economically on multiple schedules. United has 25 Caravelles in order.

Patterson and United has received its available capacity position in the

transportation market, but after other carriers get jet jets who survive. Like other airlines, United showed a first quarter loss—totaling \$2.7 million—while Pan American and was disappointing but no surprise. He blamed it on mechanical and training problems, especially in scheduling aircraft for training, but warned the airline should police its aspect of accidents. United has received

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are in
the right
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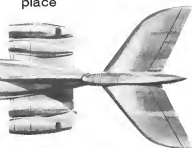
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United Airlines' Forecasts

Capacity Forecast

Year & Quarter	AirMiles Seat Miles (billions)	Pax Cost Change From Year Earlier Period	Pax Cost Per Seat Miles of Total
1959-60	1,744	-13.6	3.6
1960-1	1,794	-8.1	32.9
-2	2,132	-7.6	35.9
-3	2,576	+12.7	41.7
-4	2,469	+42.0	50.2
Year-1960	5,965	+16.1	62.4

Projected Capital Expenditures, Debt Service and Cash Flow From Operations

Year	Capital Expenditures	Debt Service	Cash Flow
1960	(800)	(800)	(800)
1961	\$110,520	\$10,647	\$80,645
1962	148,762	23,979	70,822
1963	17,246	15,697	24,789
1964	13,574	36,726	67,616
1965	12,211	16,670	59,979
1965	12,751	14,376	49,102

* Interest and principal repayment.

* Depreciation, amortization, depletion, and other expense of retained earnings and reserves from sale of surplus assets.

Projected Debt Service

Year	Debt Service Requirement	Bank Loan Requirement	Interest Expense	Total
1960	(800)	(800)	(800)	(800)
1961	\$2,970	—	\$ 5,321	\$18,617
1962	3,970	—	11,851	15,821
1963	2,992	—	12,619	15,611
1964	2,992	\$21,609	11,526	36,127
1965	2,992	21,609	16,477	41,078
1965	2,992	21,609	9,135	34,736

Projected Capital Expenditures

Year	Flight Equipment	Construction	Ground Equipment	Total
1960	\$125,304	\$5,770	\$4,623	\$135,697
1961	125,366	5,930	5,093	136,320
1962	1,832	6,359	2,175	17,316
1963	6,798	5,212	2,491	14,501
1964	6,347	6,878	2,868	16,093
1965	6,223	5,579	2,593	14,395

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This flexible escape slide developed by Air Cruisers for jet airliners provides rapid and safe emergency evacuation of passenger aircraft, particularly at extreme aircraft attitudes.

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few feet of slide resting parallel on the ground. Simple to operate, Air Cruisers escape slides are standard equipment on many turbine-powered military and commercial aircraft.

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Supersonic PRs

Supersonic transport is not against United's W. A. Patterson as being around the corner. Talks about supersonic transport to hold the New York Society of Security Analysts seem to get started in the public relations department, maybe in a response that cannot wait on the 707 or DC-8.

"The PR man gets into the president and talks about wings," Patterson said, "and the company president says, Okay, give them the business on a supersonic transport."

On perhaps no subject has not been done so well and it has a wide application up the coastlines. "It would be under these wings," Patterson said, "so it says it will put a supersonic transport on the route."

55 million in transport costs for long term investment.

United now has 22 DC-8s, four more than its contract with Douglas called for.

Production will be slowed during the month, but is expected to pick up by July, Patterson said.

Competition is being felt from other airlines with new routes and from foreign carriers newly installed into certain transatlantic operations. The latter have no schedule rights, Patterson noted, but they do take every passenger United might have caused to the international gateway, such as New York. Though not giving the cost of operations for foreign carriers, this line is coming "off the top" for United.

Seattle, American Airlines' route into San Francisco cost United \$516,000 of revenue in April. "That was one of the top six in air we've contracted," Patterson said. "Otherwise this would have gone to net."

Why, Patterson asked, does United then go on making expenditures for new routes when it appears the airline has a problem because of excess amounts of competition now? "We file," he said, "because we feel lighting may strike." The theory shows events that United might get the best award.

Capital's Plight

Capital Airlines' recent plight reflects the state toward philosophy of the Civil Aeronautics Board, Patterson declared. "With such loose entrance they would say, This one will cost you now and it will be a big, build-up." And it led Capital down the road to which it is today.

In Patterson's opinion, the Capital system is not desirable as it may go a long way to ease the problem of excessive cost outside the question of wages was brought up by one analyst, and Patterson added the transport.



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3M Materials Memo

News of material for the aerospace industry from the 27,000 products of the 3M Company



■ YOUR BIRD CARRYING A TORCH?

It might be done just that, if you're still using conventional, non-thermoconductive coatings on its hot little turbine engine. GE recently finished a truly three-proof test on its hot little turbine engine. First it was used "Nonchance" XE-5011 on the nozzle. The new two-part flexible epoxy resin system is a flame protectant that doesn't burn, even when all sorts of environments. For example, at the Marine Development Center, one their really a scorcher—XE-501111 bear the standard of NASA, for non-flammable resin by a selected reaction. In this test, where the goal is to get the lowest possible number value, at 1.33 to 2.25 was achieved by XE-5011. Three figure test are compared to a value of 1.2 for a conventional coating used, which, incidentally, also proved the flammability of XE-501111. The manufacturer's technical notes state that XE-501111 is a two-part system that is formulated to form a protective film of even 301 EETA without a put off any in one hour. In a thermal shock test developed by GE, the resin cured around a 1/4" metal core is recycled between 130° and -57° XE-501111 was applied for one hour, and in 10 hours. And six years later it was still there. It features low expanding viscosity and high adhesion to metal surfaces. It can be used in the air, it's a flame resistant to corrosion, and other features. In fact, this advanced resin is not only used in the engine, but also in other areas. Why not contact your local ELEC, TRAC, or PGM/ACTS representative, or check it out for further information.

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"We're not going to be interested in engines suggested by the government to build the government out of the cabinet it began making in 1953."
 Patterson also touched on the flight crew salaries by pointing out he would not argue that the captain responsible for the crash of a 55 million jet airliner and its passengers was worth every cent of his salary. "It's only wages," he said, "and you're not everything you should!"
 Patterson said.

He did not appear strongly concerned about the crew compensation issue. (United has acquired its flight engineers be piloted and offered training to those who were not.) This requirement signed a five-year agreement not to have engineers pilot qualified. Patterson said, this was faced with pilot demands for a third pilot in the cockpit, and would up with four men in the cockpit. "That's not featherbedding," Patterson asserted. "The pilots don't get a fourth man. They signed that five-year agreement!"

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Garlock Inc. increases the new name for The Garlock Packing Company, Palmyra, N. Y., to reflect more accurately its broad diversification of products and markets.

Originally established to manufacture mechanical packings, Garlock now produces over 2,000 different styles of packings, gaskets, seals, molded and extruded rubber and plastic products for every major industry.

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GARLOCK INC.



Hacks and Hocket Components



Leather Packings



Electronic Components

as much as a year ago. Sales for the first 10 months of the fiscal year ended Apr. 10 were about \$5,107,680.

New Offerings

Englehard Industries, Inc., Newark, N. J., principally engaged in manufacturing and selling products made of or containing precious metals, and in refining and selling such metals. Offering 450,000 shares of common stock, for public sale, offering price and underwriting terms to be applied by agreement. Of the proceeds, \$2 million will be used to finance an outstanding 4½% note; a portion will be used to reduce short-term indebtedness on bonds; the balance will be added to working capital.

CEAR, Inc., Arlington, Va., engaged in commercial electronic computer services, offering its facilities to governmental, military and commerce. Offering a 122,000 shares of Class A voting stock, to be offered for subscription by holders of outstanding Class A voting and Class B nonvoting stock, of the sale of one new share for each four shares held; record date, subscription price and underwriting terms to be supplied by agreement.

The company is engaged in an expansion program and has made arrange-

ments to acquire Telesystem Services, Inc., Los Angeles, and is planning to expand its Atlantic facilities and to open centers in New York, Houston and Los Angeles. Proceeds of the present offering will be used to the extent necessary to defray the full cost of the acquisition of Telesystem Services, and the balance will be applied to other phases of the program. Required additional funds will be obtained largely from bond issues and other financing as deemed advisable.

Teleglobe Corp., Stamford, Conn., engaged in handling data processing, transmission and display devices, including electronic stock and commodity quotation services for use by the financial community, and special reporting and off-line stand program and fixed program electronic data processing systems for industry in general. Offering a 50 million of 6½ subordinated sinking fund debentures, due May, 1980 (with attached warrants), and 240,000 shares of common stock, for public sale in units of a \$1,000 debenture, with five warrants to purchase 20 common shares initially at \$15 per share) and 40 shares of common stock, offering price and underwriting terms to be applied by agreement. Of the proceeds, \$6,115,000 will be used to pay off the current portan-

ce of borrowings under a credit agreement with a bank, and the balance will be applied to the company's construction program of approximately 50 sub-station bonds in 1980.

Schwartz Engineering, Farmaclose, N. J., engaged in the design, development and manufacture of measuring, measuring, recording and controlling devices for industrial and military applications. Offering a 168,000 shares of Class A common stock, at \$1 per share. Proceeds will be used to increase the company's current activities, to take advantage of diversification opportunities, and to finance new working capital. The 168,000 shares are part of an authorized issue of 220,000 shares of 10 cents per share common stock.

Vector Manufacturing Co., Inc., Southampton, Pa., engaged primarily in the development, engineering, manufacturing and sale of radio telemetry equipment and systems consisting of electronic airborne and ground station subcomponents for use in space probes, satellites, rockets, nuclear reactors and in the aircraft and remote industries. Offering a 250,000 shares of common stock, 100,000 shares to be offered for public sale by the issuing company, and 150,000 nonvoting shares to be held in trust. Offering price and under-



America's biggest, most versatile satellites

sponsored research and development projects, totaling \$1 billion.

Lockheed leader of the corporation, Clarence Robert E. Green told stockholders at the annual meeting, details at \$2.8 billion, up about 15% from the same period last year, but slightly below the total for the best of 1969.

Commercial transport sales accounted for each one-sixth of the total sales for the first period. Green said, adding that the Electric program has been a down on profit mark by the other six-sevenths of the corporation's revenue producing activities.

Lockheed delivered 13 Electra transport to 11 different customers in the first quarter but the total sales price was \$2.1 million less than the recorded cost of construction. While price of planes to the customer is fixed at the time of contract signing, Green indicated that Lockheed cost pricing is set according to the number of lines added to hand as of the end of the year. "Ede" after manufacturing Green said Lockheed manufactured the total potential weight of the beginning of the future transport program (AWM Max L, p. 177).

Concerning future Electra production, Green said 78 of the planes will be delivered between now and November, as a delivery production rate

increases, also as the birds will move production of the Navy P3V-1, the Navy's anti-submarine version of the Electra. First production plane of this type will be used next.

The company's first satellite made Polaris will be according to Green, a production item. Green pointed out that by the end of 1969 there will be 12 operational Polaris rockets aboard submarines, adding that nine Polaris-carrying subs are being built and that the Navy has indicated a long-term goal of 45 Polaris submarines, each carrying 10 missiles.

Among the subsidiaries of the Lockheed-Aerostar, Model 60 (AWM Apr. 25, p. 95), and its investment production. Green declared that Lockheed's subsidiary, Frank Fawcett Co. has been developing mining the field of financing production of the satellite needs.

Acquisitions And Mergers

Chaparral Industrial Metals, Inc., Piedmont, B. C., has acquired A. Holt & Co., manufacturer of gold and silver plated plate which will be used in advanced developments of solid and laminated materials for microelectronics devices and other electronic uses.

The Field Co., Philadelphia, Pa., has acquired the assets of Metall, Inc., of Pasadena, Calif., to expand Metall's Instrument Division and electronic testing equipment line. It will operate as a division of Aerostar, Richard Doolittle, Metall president, will join the Field Co. staff.

Jack & Horvath, Inc., has purchased assets and manufacturing rights of Radio-Lock Company, Inc., South Gate, Calif., to extend the company's diversification plan. Radio-Lock's operations and trading will be moved to Cleveland, Jack & Horvath headquarters.

Financial Briefs

Malibu Maryland Music Corp., Glendale, Calif., reports that 1969 sales and earnings were the highest since it ended issuing activities in 1957 and began designing and producing records and records control. Sales in 1959 were \$1,755,447 compared with \$1,705,750 in 1958. Earnings in 1959 totaled \$214,465 compared with a loss of \$318,587 the year before.

Goodwin Co. of America, Inc., backing totaled \$1,800,000 in April issue

are being built at Satellite Center, U.S.A.



Satellite Center, U.S.A., is located on the San Francisco Bay west of Danvers, California. From Lockheed's new Satellite Systems Building joins the Agena satellite of the Air Force Discoverer program, the Agena B planned for lunar and deep-space probes, and the satellites for the Air Force's Midas (mobile defense alarm system) and Selenia (strategic surveillance system).

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wiring lines to be supplied in accordance. The wiring steelholders have or will denote 100,000 shares to the company for the purpose of this offering to the sale of the stock involves no increase in the outstanding shares. Proceeds of the sale of the 700,000 shares will be used for various purposes in conjunction with the company's expansion program, which includes a new Space Reclamation Center being constructed at Timon, Pa.

William Franklin Investment Co., Inc., William, Mass., engaged in the manufacture and sale of wire cloth, wire mesh, wire grids, from for 20 year shells, screen cloths, lenses, composite geotextiles, space parts for children's watches and other items. Of King is 700,000 shares of common for subscription to common stockholders' stock date, subscription rate and subscription price to be applied to several items. Certain individuals have or will agree to purchase an unspecified number of shares of stock not purchased by shareholders.

In February, 1968, the company acquired all the outstanding stock of Electro-Mac Laboratories, Inc., Long Island City, N. Y., a manufacturer of potentiometers and detectors, and in March contracted to purchase all the outstanding stock of Bosch Manufacturing Co., Inc., Dunbar, Conn., a manufacturer of bonded coil winding machines. Proceeds will be used to pay the balance of the purchase price for the Bosch stock, to pay the \$10 share of common stock held by the Secretary of the U. S. Treasury in connection with the Reclamation Finance Corp., to pay the 6% interest notes issued in part payment for the stock of Electro-Mac Laboratories. An balance will be for working capital and other corporate purposes.

Esper Mfg. & Electronics Corp., Sutter Springs, N. Y., engaged in the design and manufacture of electronic components and electro-mechanical devices, the major products being special and electronic power supplies and various types of subassemblies and other electronic components used in machines, computers, radio, video and other equipment. Offering a 10,000 shares of common stock for public sale, offering price and underwriting fee to be applied by agreement. Of the proceeds \$475,000 is to be used for the estimated production costs for the company's proposed astronomical apparatus \$200,000 to begin a break loss and to discharge \$25,200 of 6% debt, while the \$5,800 of interest held by Ted Pinsky, a company officer. The balance of the funds are to be added to working capital.

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For complete information, write for Stratolok Bulletin S-6.

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AERONAUTICAL ENGINEERING



BRANTLY B-2 helicopter has top speed of 150 mph., useful load of 420 lb., and is powered by 180 hp. Lycoming VO-503 A1A.

Aviation Week Pilot Report:

Speed, Low Vibration Mark Brantly B-2

By Robert Starfield

8-2 INSTRUMENTS are as perfect. On floor below are carburetor air, mixture controls.

New York—Recently delivered, two-place B-2 helicopter is a responsive and fast aircraft that, at a weight close to its 1,250-lb. maximum gross, cruises at an indicated 95 mph during a flight evaluation by Aviation Week magazine's Kester, level to its target rotor blades in the smoothness of the rotor system—particularly the absence of "v and test." There is a lack of random vibration (something like a wheel out of balance) common to most helicopters at cruising rpm during starting, ascent and descent.

150 mph. Maximum

Top speed of the B-2, which can be achieved at about 75% of maximum continuous power is 150 mph. Powerplant is a Lycoming VO-503 A1A of 180 hp. Cruising engine speed runs from 1,700 to 2,500 rpm. Fuel gauge is 91.96 inches.

The B-2, designed for private and commercial use, finds significant enjoyment in the process of being manufactured made its first flight in 1951. It was re-certified in April, 1959. Base cost is \$19,910. There have been sold last year. Ten have been delivered this year. As of Mar 1 Brantly was in receipt of 18 firm orders from the 17 dealer, with deliveries scheduled through August.

Production schedule for 1960 calls for one helicopter a week to be produced at the Frederick, Colo., plant of



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The extreme demands imposed by these properties make that techniques and equipment for handling more common cryogenic fluids, such as liquid oxygen, cannot be extended to liquid hydrogen. An entire new technology is required.

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Air Products services for liquid hydrogen handling systems are complete ... include design, engineering, manufacturing, installation and operation. These services are completely integrated to assure proper consideration of every requirement—flow rate, pressure, rate and type of usage, ambient conditions, method of delivery.

Producing and handling liquefied gases at ultra-low temperatures has been the specialized business of Air Products for over 20 years. We will welcome the opportunity to answer your questions about obtaining and handling liquid hydrogen, and to put our experience to work for you. Air Products, Inc., Allentown, Pa. Phone: EXpress 5-3311.

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CYLINDRICAL tubes of B-2 for spherical hydrogen nose canopy and two small overhead hydrogen bubbles for nose landing gear.

Brantly Helicopter Corp., the main offices of which are in Philadelphia, Pa. One of the B-2 models still holds a civil rating certificate, an official rating company. Five models were delivered to the U.S. Army last year for evaluation.

The B-2 is being demonstrated to the Brazilian Air Force.

Most recent B-2 change is about 100 lbs. in total of the tubular base of the tail cone, since flight tests showed it was not necessary to give a positive stock slope. Stabilizer now is optional item. Most significant of the refinements developed between first flight and modification is its rotor with the outboard wing—a horizontal and vertical wing positioned at approximately 45° to the fuselage of each of its three blades.

The outboard blade has a measured section with a 29% thickness ratio and an effective chord of 0.94 in. It is set at an angle of incidence which is 4 deg. greater than the outboard blade, which has a modified NACA 6517 section with an R in chord (leading edge).

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Brantly B-2 Performance

Maximum speed	150 mph
Rate of climb (sea level)	1,500 fpm
Lift/drag	7 lb/cu ft
Range	100 mi
Fuel consumption	10 gph
Showering (100°)	4,700 ft
Service ceiling	10,000 ft

wing is offset a distance of 7.67 in. from the hub.

It is to eliminate feedback in controls, eliminate panel resonance, hold a low level of vibration and require rotor control in the low-speed range—making it possible to start and stop the rotor with a high wind.

Discussions have at Westchester County Airport with NACA, Brantly model number 10. Along with Avco Aeroquip, jetted via Ricardo Glenn, president of Alfa Aviation Latin America, distributor of the B-2 in Bogota, Colombia, South America.

Sitting in its web the B-2 has the appearance of a horizontal air stream. It is a clean, unadorned structure, small and compact, with knowledge of stress/strain construction. The cabin is cylindrical with a spherical hydrogen nose canopy and two overhead hydrogen bubbles for additional headroom.

Approximate weight of the structure, complete with rotor, doors and with engine and transmission oil, is 3,000 lb. For the maximum gross weight of 7,000 lb. the total of the tubes, nose, tail and baggage loads cannot exceed 500 lb. with doors installed or 610 lb. with doors retracted.

Fuselage from the cabin section off a central connecting center and tail section. Primary structure primary support for the rear landing gear struts, nose rotor and transmission, and tail section. The tail section supports the tail rotor, the drive and controls. The

four ft (50 lb.) baggage compartment is located in the forward end of the fuselage section, just aft of the nose bubble.

With the B-2 on the ground, ground-rotated by a sturdy gear. Four shock absorbers of the dual gear rack consist of an air struts in series with a synthetic rubber coil, which limits travel. Gear track is 5 ft 0.25 in.

Doors on either side of the Brantly cockpit hinge upward. One has to duck when approaching the aircraft be-



BAGGAGE capacity is 50 lb. in 10 ft. Compartment has one of its struts fixed in forward end of fuselage section.

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BRANTLY plant at Perkasie, Pa., has a production schedule of one B-2 bomber a week during 1990. Five were delivered in 1979.

case of the geometry of the forming blades. Setting is reasonable, though there is not an overabundance of room. Width of the cabin section is 9 ft 11 in. Controls are dual, with the microphone button on the pilot's cyclic stick only. Navigation lights are available in optional equipment.

B-2 Instrumentation

B-2 flight and engine instruments are mounted on a modular pedestal, with Narco Spectrometer VDF-3 units just beneath. At base of the pedestal are inter-rogation switches and control handles. Instrumentation did not include a pre-flight indicator; for this flight instrument were made by trans-bus-board checks. Centered between the pilots, on the floor, are levers for instruments and engine control. Against the rear front is the nose-man switch plate indicator, the fuel shut-off and manual interlock controls.

Blades slowly were turning when we climbed into the small aircraft. Powerplant limitations include wing speed of 308 to 900 rpm, plus operating speed of 2,390 to 2,960 rpm. Engine operation between 2,700 and 2,600 rpm, (total vibration range) is to be avoided. Ampere is limited at 100 mph.

Yield elevation at Woodward-Clyde is 400 ft. Sea level pressure at takeoff

Brantly B-2 Specifications

Gross weight	1,600 lb.
Empty weight	910 lb.
Useful load	670 lb.
Length overall	21 ft 9.1 in.
Height	6 ft 11.75 in.
Wing (value section)	7 ft 11 in.
Wing span	4 ft 8.25 in.
Disk per track	5.55 in.
Disk loading	5.9 lb./sq. ft.

Max. rate (five blades)

Chamber	25 ft 11.25 in.
Inboard flying hinge offset	2.67 in.
Inboard blade chord	8.84 in.
Inboard blade incidence (five pitch)	7 deg.
Outboard flying hinge offset	10.55 in.
Outboard blade chord	8 in.
Outboard blade incidence	NASA 8002
Outboard blade incidence (five pitch)	7 deg.

Tail rotor (two blades)

Distance	4 ft 3 in.
End chord	4.187 in.
Tip chord	2.705 in.
Height from ground (overall in debt)	29 in.
Full capacity	105 lb. (70 pd)
Dragage capacity	90 lb. (50 pd. H)

Rotating VDF100-AAA of 180 hp. Engine speed, 2,700-2,900 rpm. Engine to rotor ratio, 2:1, engine to tail rotor ratio, 2:1. Recommended over-haul period: 500 h.



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INBOARD blade has a symmetrical section with a 20% thickness ratio and an effective chord of 6.64 in. It is set in an angle of incidence which is 4 deg. greater than outboard blade.

was 88.09 in. Outside air temperature was 57°F. A light wind was blowing from the northwest at 2 kt.

Initially the B-2 was hovered at 12 ft manifold pressure and 1,000 rpm. Fuelly good power settings under these conditions. Vibrations were not excessive but the noise level was somewhat in the extreme. Additional soundproofing is now worked into production aircraft.

Walter L. Heppner, vice president, Kite Helicopter Corp., 52 B-2 deliveries to, Ambley, Pa., told AVIATION WEEK: Best rate of climb of the B-2 is open fuel at 1,100 rpm. With power advanced to 24.5 in. and 2,310 rpm, the helicopter moved forward and up at 10 mph. Speed was increased to 15 mph at 400 ft, to 55 mph at 500 ft. Altitude of 900 ft. was reached in one minute.

At 1,800 ft., with power at 24.75 in. and 2,900 rpm., the B-2 indicated 95



FUELIZER hub for the same rotor is shown in photograph above, together with the standard flying hinges for the rotor blade.



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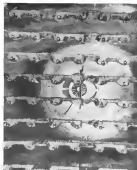
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Anti-Icing System Tested on GE Aft-Fan Engine

General Electric has begun a new 12-ft. diameter test cell to evaluate the effectiveness of the engine's anti-icing system. At right, a GE CB6013 aft fan engine is surrounded by a 6-ft. diameter pot, through which a fan at 100 doors secondary air to ensure thrust. Hot air enters in the pot provide anti-icing for compressor leading edges of the engine.

mph. From this altitude the B-2 was craned up to 1,700 ft. and lowered at 24.5 in. and 2,510 rpm. With power at 12 in. and 2,510 rpm, the rotorcraft again indicated 97 mph at this altitude.

The B-2, with its chain engine from, picks up speed quickly. It is sensitive and quick on the controls, quite responsive both to light pressure and to power applications. Its vertical climb speed is above average for its class of aircraft; its descent speed is a per-odd similar type helicopter.

Average endurance doesn't exceed that of the B-2, even between 10-70 mph. Best glide ratio is 60 mph; is about 1:1. To improve present performance characteristics—to work into the B-2 a better rate of descent, more a light rotor will lose rpm, faster—there is a new rotating 1.5 ft. of weight into the outboard section (from the hinge out) of each blade.

Several modifications were made from altitudes of 1,100 to 1,500 ft. the B-2 in each instance being very responsive in pulling out of the autorotation. In one instance, following a pull out close to the deck, Oliver told the B-2 to even speeded, using 20 in. and 2,410 rpm.

When the B-2 engine speed is adjusted so that the rotor is near the center of the 2,700-2,900 rpm range, the throttle and collective pitch are

checked will maintain engine speed within the given-to-load throughout power-on flight. A landing also can be made a short adjusting the throttle.

In the latter system, the engine will be running for a short period in the critical altitude range (2,000-2,600 rpm) with the rotor still engaged. This can be avoided by "spitting the wheels" after landing and allowing the rotor to disengage before the engine speed drops into the critical range.

Other shock situations related to

handling tendencies of the gear drive bearings at a slight over-high attitude. Each also dampen aerodynamic a flipper valve to shift resistance at track down. The rotor blades during compression of the disc with the air flow being governed by a rotating jet. At flight termination and during engine shutdown procedures, the rotor brake is applied after the rotor speed has decreased to less than 200 rpm.

The French rotorcraft engine water without exhaust gas from the air



Kaman HU2K with GE J85

Model of new turbo-powered utility helicopter, the Kaman HU2K, shows 400-hp jet fuel mounted on the side of landing to provide increased speed, range and versatility. Detachable pod, which houses a General Electric J85 engine, could be used for flight testing in an auxiliary.

Many Parameters, One Elastomer



SILASTIC® meets varied specs in Convair F-106

When you're calling out materials on a price or specs, isn't it a help to have one material that can meet a variety of rubber needs? A material that's been proven in all flight regimes? Engineers at Convair San Diego, Div. of General Dynamics Corporation found it so. The material is Silastic, the Dow Corning silicone rubber, and they specify it for every application, showed the Mach 2 plus F-106 all-weather interceptor.



A few of the uses are illustrated here. As both you see rubber parts... plug you action used for checking out instrumentation. Located in the aft fuselage bay, they are subject to high flash temperatures during rocket firings. The reliability of Silastic in this part is reported excellent, with no failure even in the presence of chemicals or adhesive gases. (Wide bandpass area also of Silastic.)

A completely different application of Silastic is shown at right top: use of wire connectors in the air bleed system. All connections are covered with a flexible hollow of glass reinforced Silastic. The duct beneath carries air at 300 F. and though there is insulation between duct and cover, the Silastic must still tolerate high temperatures while retaining its rubberiness and sealing ability.



Among other uses of Silastic aboard the F-106 are three hollow extrusions in the air-cooling compartment door. They withstand severe temperatures, maintain a firm seal after extended lengths of time under compression.



Silastic stays rubbery from -100 to over 500 F., resists aging, weathering, oxidation. Your rubber parts supplier will engineer a part made of Silastic to add reliability to your design. For name of nearest fabricator or more data, write Dept. 9602.

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First Flight of Turbine-Powered Skeeter

Sikorski helicopter is soon being test flight powered by a Blackburn Turbo Sover 681 gas turbine engine. Engine initially develops 425 hp but was tested to 700 hp for the duration. Turbo-propeller Skeeter, manufactured by Sikorski-Bell Helicopter Division of Westland Aircraft Ltd., is in service with British and West German forces.

gear to create a pressure drop in the exhaust manifold or reduction which draws cooling air through passages formed by cylinder head bolter. Cooling air enters the engine compartment through air scoops located near the top of the engine compartment on each side of the fuselage. In forward flight the volume of cooling air is increased by air effect.

Cooling for the engine oil is provided by an external Hottelux type cooler aft of the engine compartment. Intermediate gear box is at the lowest point in the tail rotor drive and is a convenient oil pump for the skis.

The main tail rotor shaft is hollow. It is keyed in a hole extending the length of the tail section with bearing supports provided at about 15 in. intervals. It is lubricated via a fixed external screw pump in the intermediate gear box.

Tail rotor extension shaft is also hollow. A similar stationary screw gear pump is driven by the intermediate gear box up through the shaft to the tail rotor gear, with a return passage provided by the space between the shaft and its housing. Return line is located near the top of the tail rotor gear box.

720 Demonstrates Minimum Landing Roll

Boeing 720 reaches cruise jet thrust part has been loaded within 2,200 ft over a 50 ft altitude at a landing weight of 115,000 lb in the course of Federal Aviation Agency certification tests. Minimum runway landing run across plughed distance a 6 mph. In level flight, full-power wing loading edge 50

acted automatically in conjunction with trailing edge flaps to provide increased lift at high angles of attack, reducing ground roll by about 10% (increased lift offset early landing and takeoff speeds by 7-11 mph).

The new Boeing 720s used in the

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These no-draft Alcoa Forgings for F-104 save Lockheed 40 cents on the dollar



DORSAL FORMER
Precision forged by Alcoa to finished dimensions—with zero draft



WINGHOOK FITTINGS
Alcoa no-draft forgings with contours forged to precise angles

Take a close look at the Dorsal Former at left. Notice the thin, tapering ribs. Alcoa forged this part to finished dimensions, with no inside taper to machine off.

Alcoa supplies Lockheed with many close-tolerance, untapered rib forgings. The Airspeed Fittings are sophisticated examples. In all, the F-104 carries 99 no-draft forgings. Lockheed estimates the average saving over conventional machined parts comes to 40 cents on the dollar.

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LOCKHEED'S F-104 STARFIGHTER

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NATO VTOL Program

Five-NATO interested nations have already begun work to which left a construction program for a steady VTOL fighter to be operational within four to six years.

General operating requirements for the VTOL fighter have been drawn up by SBAFC and transmitted to NATO's aircraft production board. Considerable controversy, however, still remains between and among members of the program.

Manufacturers interested in the program will be actively pursued shortly. Many companies currently are exchanging ideas between themselves in order to work out a common but, British participation, in particular, has been working out West European interest in their own VTOL projects without, it seems, as much success as British reports on the subject indicate.

It seems certain that NATO's VTOL program will be a European show and that final specifications will be finished developed and built by NATO's European members. U. S. VTOL concepts, however, will very soon be the program via Europe—some made and others in the works—between American and European aircraft companies. Republic Aircraft VTOL work, for example, will get in which through Republic's recent agreement with Fokker of Holland (AVR No. 28, p. 12).

No firm timetable has yet been laid down by NATO staff. It is generally hoped, however, that the VTOL program will be finished up only next year.

current certification program have lagged more than 240 in flight time, and have attained a maximum speed of Mach 0.93. A leading edge erosion which increases the sweep angle of the wing between the leading and the subsonic regions gives the 720 a boost in top speed of more than 14 mph, compared with the bigger 757s.

PRODUCTION BRIEFING

Low, Inc., Santa Monica, Calif., will produce automatic flight control and stabilization system for Bess Q-3C target drones under \$1.7 million follow-on contract. The flight control system, which accepts radio-command signals, mediates control and rate gyros, attitude controller, autopilot and attitude sensor, power supplies, actuators and interconnecting wire circuits.

AllResearch Mfg. Division, Phoenix, Ariz., will build additional air turbine motor for the Republic F-105 fighter bomber under \$13,000 contract.



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To stabilize the attitude of a space vehicle the Bendix-Pacific Cold Gas Thrust Controller has demonstrated its accurate effectiveness on the Discoverer and other Satellites.

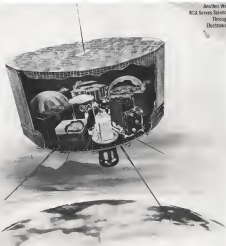
The Controller, developed by Bendix Research Laboratories in collaboration with Bendix-Pacific, produces thrust proportional to an electrical signal by discharging compressed nitrogen through the nozzle. The Controllers are installed in pairs to stabilize each of the three axes.

The model illustrated, which weighs only 15.5 ounces, incorporates a 2-stage pressure control valve and has a maximum thrust capacity of 20 pounds. Other configurations are available.

Complete information is available on request.



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The entire TIROS satellite, its component systems and associated ground equipment were developed and built by RCA's Astro-Electronic Products Division for the National Aeronautics and Space Administration under the technical direction of the U. S. Army Signal Research and Development Laboratory. Included in the satellite are two TV cameras equipped with shutters so they can take still pictures, tape recorders to

store the pictures when a set of ground station tags, TV transmitters, command receivers and timing clocks for function control, radio beacons and telemetry equipment, and numerous auxiliary devices to control satellite dynamics. Power is supplied by storage batteries recharged by an array of 3200 solar cells which convert the sun's energy into electricity.

Significant to it is, TIROS is a beginning, not an end. Future satellites and space probes will be far more complex. Yet they will grow out of the experience and capabilities in space electronics, attitude dynamics and structural landing techniques that made Project TIROS a reality. To find out how you can draw on the unique research and development capability, get in touch with the Marketing Manager, RCA Astro-Electronic Products Division, Princeton, N. J.



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MANAGEMENT

House Group Asks Procurement Changes

By Katherine Johnson

Washington—House Armed Services Committee, following a week of hearings on military contracting highlighted by sharp criticism of the incentive-type contracts which cost by Air Force and Navy, has requested the General Accounting Office to draft defense procurement legislation that would:

- Assume maximum use of competitive advertised bid contracts
- Assume maximum competition in unprofitable contracts
- Discourage "sole source" procurement practices by requiring detailed production drawings and details from contractors as first competition can be introduced in procurement as early as possible
- Set standards to encourage award payment in the selection of the "lowest price" contract
- Require that cost reimbursement, particularly on cost-plus-fixed-fee, incentive, and price-reimbursable type of contracts, be complete contracts, and fixed.

Final profit awards to contractors for "low efficiency, product improvements and advances in the state of the art" is also being sought by the government via the "incentive demonstration" by the contractor.

The attack on incentive contracts appeared to be the most objective of the committee sessions—led by Chairman Carl Albert (D-Ga.), who last year conducted a successful incentive campaign for a three-year "as of" revision of the Reconstruction Loan and defaulted as well as that would have required the Reconstruction Board to give special consideration in cost savings by manufacturers under incentive contracts in awarding contract profits (AW July 3 p. 25). Defense Department and the Air Force recently urged the amendment on the grounds that manufacturers who save on costs under the incentive that they will be allowed to retain 30% of the savings should not be required subsequently to refund it to the Reconstruction Board. The last share of the incentive profit determination of the Board has been directed at strategic lines performing under incentive contracts.

Vinson recently contended that with the incentive contract there is only the chance of a cost saving, and that the savings indicates that the contractor was over paid in the first place.

Reconstruction Board and General Accounting Office supported Vinson's position. Under existing, the Army also opposed.

"We have covered the matter

many, many times but have never found any type of procurement in which the incentive type contract would be advantageous to the government," Chairman Johnson stated. Secretary of Army for Logistics, told the committee in response to questioning, he was alternative to the incentive contract—in the procurement area between the cost-plus-fixed-fee and incentive contract in awarding other procurement contracts. Johnson said that, in determining contract profit, Army gives no additional to the contractor's "bottom" cost and expense in the allocation of profit. In fiscal 1959, 291 Army incentive-type contracts annually, paid at \$456 million, are subsequently reported at \$633 million, a reduction of \$77 million. Profit on the contracts is \$1 million by \$8 million.

The basic difference between the incentive and price-reimbursable types is that, in the incentive type, profit and cost-plus are calculated in advance of actual performance and in the price-reimbursable type cost allowances are based upon the results of actual performance.

Air Force and Navy defended their



German Steel Firm Accepts Beech Queen Air

First export delivery of a Beechcraft Model 45 Queen Air executive transport was made in Rocking Hill & Steel Co. of Wollington, Germany, at Waltham Hill, (AW Aug. 11, p. 121). Taking delivery was Miss Eppie Jell, of Trossel GmbH. Beech distributors at Europe and Capt. Robert J. Jell, Rocking Hill pilot. Also a flight with Goodrich & Co. boots, new optional seats. Capt. Jell has the Queen Air to Germany via Newfoundland, the Azores and Portugal. It will replace a Beech Twin Otter.



Bristol Type 186 Moves to Farnborough

Bristol Type 186 motor start Mark 1 motor control (AM) for the Type 186 is moved to Farnborough for structural tests. Second motor is being tested for first flight later this year. (By Howard Green.) DGH 43 tailgate will be flight tested later this month in a Glendon jet. The Type 186 also may be used in a rocket testbed.

use of sensitive contracts had concealed that undisclosed profits "could" be made by contractors.

Qualifying that there were in a "total target" price Philip B. Taylor, assistant USAF secretary for contract aid.

"We have agreed an increase in the cost of this type of contract in appropriate circumstances as one of the most fundamental means of ensuring an incentive to contractors to reduce costs."

Mr. Geo. W. A. Davis, director of procurement and production for the Air Ministry of Contract Management, told the committee that USAF's use of incentive contracts "has steadily declined"—from 31% of the dollar volume of procurement in 1956 to 16% in 1970.

Paul A. Brady, undersecretary of Navy, testified that the incentive contract is "sold to the contractors of the Navy Department in order to prevent complex equipment in the field not to be sold through fear of this type of contract will not available. It is sold to favored sub-contractors on an individual basis and end type contracts which in our opinion are not as effective in controlling costs."

Thomas Coughlin, chairman of Congressional Budget explained the weaknesses of the incentive contract to the committee.

"In the incentive contract the contractor bears the major responsibility, although costs are less than estimated and without reference to the actual."

It is obvious, then, that the reasons which motivated the contractor's efficiency, the contractor may risk greater profits than could reasonably have been foreseen. Such profits may be due to contractor estimates of target costs, they may also arise from unanticipated cost savings attributable to the impact of additional delivery and production volume, from lowered material prices of sub-contractors or from other extraneous causes.

"An incentive-type contract may yield excessive profits because of uncertainties

which decrease in the cost of purchased items, unanticipated in setting the final target or because of contractor errors in estimating the future costs which material into final calculations. If it is of the nature of surprise, to anticipate that, in either case, the contractor has been allowed a target cost, some costs which he will not incur, in fact, occur while the contract together with a profit margin and fixed, in the final settlement, he receives a bonus under the incentive formula, but not having incurred the cost.

"This is truly a scandal. It can hardly be stressed that the contractor's efficiency—his right even be sufficient—has physical part in his calculation. He has done nothing more than show a decrease in costs that were unanticipated or unaccounted for in the first place."

A study by the Congressional Budget of the 25 contractors whose total receipts were the highest during the period from 1951 through 1970 showed that the profits on the fixed price incentive contracts received averaged 35% of sales—substantially less than the 18.1% for fixed price contracts or the 18.6% for price reimbursement contracts.

"The various witnesses" that this indicates that incentive type contracts are more advantageous to the government than fixed price or price reimbursement contracts is substantiated by a comparison of the profit percentage of net worth of the contractors, Coughlin told the committee.

"The incentive contractors realized an average of 47 per cent return on allocated net worth, that the fixed price and price reimbursement contractors, specifically, for the years included in our study, the overall and average contractors, using incentive contracts performed only 26.7%—a difference of approximately 20% with government facilities, reduced profits averaging to 11.1% of the total net worth allocated to acceptable production. During the



MOTOROLA Military Electronics Division

EVOLUTION & REVOLUTION

REVOLUTION in electronics may have its genesis in the evolution and synthesis of four prime areas: the rapidly maturing technologies of semiconductor development and production, surface passivation and stabilization research, electronic ceramic engineering and controlled thin film deposition. Synthesis of effort in many scientific and engineering disciplines is required to achieve breakthroughs in these areas and accelerate the evolution from conventional to microelectronic circuitry. The Solid State Electronics Department of Motorola's Military Electronics Division is exploring this approach as the key to long life and reliable performance of electronic equipment by eliminating excessive complexity in component interconnection.

RELIABILITY requires the simplicity of point-to-point circuits, which further yields a substantial size reduction. Highly specialized engineers, physicists and chemists, working at Motorola, are making significant contributions to the state of the art. Other well-qualified scientists and technicians seeking professional growth will find stimulation and challenge in this environment.

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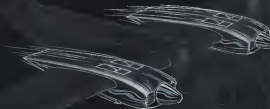
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The all-new 500B mounts two LYCOMING IO-340-B1A engines that develop 200 HP each with 40-inch, **FULL FEATHERING, THREE-BLADED** Hartzell propellers! With a top speed of 232 mph, this quiet, new **AERO COMMANDER** will cruise at a steady 222 mph.

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The brilliantly efficient conception and structuring of the new nacelle to minimize the frontal area that drag is substantially reduced, vastly improving efficiency and performance. **GEAR IS FULLY RECESSED.** Above-the-wing exhaust covers escape noise away; inside, it's **WHISPER-QUIET!** Luxurious, new leather-trimmed interior, in your choice of elegant colors.

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AVIATION WEEK, July 16, 1988

some period, the remaining contractors of the 25 studies, who will study their own facilities, and whose reports were made predominantly (95%) under fixed-price and price reimbursement contracts, received only 42.6% of the total set aside allocated to negotiable acquisition during the study period."

The House Armed Services hearings were part of an investigation of defense procurement policy which the Reauthorization Law extension directed the

House and Senate Armed Services Committees to make. The Senate committee has scheduled three days of hearings, May 20-25. The two committees are expected to make reports by Sept. 30. Under the law, these will be followed by studies of reauthorization policy by the House Ways and Means and the Senate Finance committees. These studies will be used by Congress in considering further extension of the reauthorization law which expires June 30, 1991.



Polish Sailplane, Sport Plane Models

Polish sport industry exhibitor at Leipzig Technical Fair showcased only of three two models: a competition sailplane and a two-place sport plane. Sailplane is the "Marta Nowak", a single place glider with a 49-lb. (22.5) 154-lb. (70) and 5-4 1/2' height. Gross weight of the "Marta Nowak" is 470 lb. Fixed speed is 154 mph. Two-place sport plane, the PZL 302 "Koc", has a normal cruise speed of 120 mph, and is powered at 130 mph. Rate of climb at sea level is about 500 ft/min. Wingspan is 18 ft, length is 25 ft, and height is 4 ft. Polish sources of the Fair would give no indication of price or delivery dates for either aircraft.

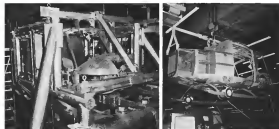


101



HU-1A Iroquois assembly line at Bell Helicopter Corp.'s Renton, Wash. plant indicates high production rate for the Lycoming T-55 powered Army helicopter. Detail component assemblies are made up on line at left, then fed into two major assembly pits at left, rear.

Bell Produces Turbine-Powered HU-1A Iroquois



Fuselage components, including left and right knee frongee beams, roof, nose, firewall and engine coverings are joined in the massive upper pit (left). Cleared cabin subassembly then is lifted by a crane to the cleanup position. Fuel bay is just behind cabin door.



HU-1A windshield, bucket electrical wiring and other detail parts are installed at cleanup stations above, left. Cooled lead-up rollers above, right. Rubber brake pads and other systems are installed under the deck, which has been fitted earlier, left is removed as maintenance personnel Lycoming T-55 turbine is installed in position at right and hydraulic lines, water electric wiring and belts are fitted. Assembly has been lifted by placing slabs on blocks to provide room for "creeps" to walk under the assembly. Tail rotor is then mounted vertically high to clear obstacles below, left. Main rotor hub and blade assembly are lifted into transmission, and now the end of the line of control systems are checked out and hydraulic systems are run out under power. Electrical system also undergoes automatic check using the hole count analyzer that can check 150 circuits in proper sequence. Wiring is checked prior to entering assembly area.



JUNE 20, 1960 Aviation Week



F. C. NASSER

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IS LAUNCHED

SAC IN TRANSITION

The changing role of the Strategic Air Command in the national defense picture will be detailed on June 20th in a special 26-page report prepared by AVIATION WEEK editors with on-the-spot coverage of the SAC Command—The nation's shield against aggression.

This exclusive report will be published in answer to the growing requirement for an expanded national understanding of SAC's changing role as the primary deterrent force guarding national security. The annual R&D issue will be devoted to this message which is today's most challenging subject.

The Strategic Air Command's deterrent posture has undergone complex and fundamental changes in its transition to a Strategic Aero-Space Command—with its formidable bomber fleet soon to be reinforced by intercontinental ballistic missiles operationally deployed to instantly counter any aggressive action.

The transition of SAC is one of the most rapid and exciting events in the history of our nation and its defense. What SAC needs, what lies ahead and the weapon systems to be employed in the immediate future will be key subjects included in this first-time technical evaluation. The impact of new technologies and weapon systems has changed the entire defense concept and the response of SAC to these new requirements has been effective and positive.

AVIATION WEEK editorial teams are now engaged in the compilation of the new SAC story—one that will generate world-wide readership. This issue, "SAC in Transition," offers manufacturers and suppliers of the aerospace industry an unusual opportunity to advertise and identify their role in the national defense effort.

A Special
Aviation Week
Report on the
Strategic Air Command's
Transition
into the
Aerospace Age

Aviation Week
... Space Technology



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Full blast

The Navy's F4D-1 Skyray goes up to its limit. With an afterburner, the Skyray develops 16,000 pounds of thrust, and from a standing start it will climb 50,000 feet in about 2½ minutes.

Douglas Aircraft built the entire front section of the afterburner with Stainless Steel. Stainless can withstand the 1000°F temperature that builds up here when the Skyray is under full blast. And because Stainless Steel has such exceptional strength, Douglas designers could use it in thinner, lighter gages. No other metal can match Stainless Steel's combination of heat resistance, strength, corrosion resistance and economy.

United States Steel makes several types of Stainless Steel for aircraft and missiles. For example, there are USS Types 301, 321, 347 and USS Stainless "W." If you would like more information about any of these remarkable steels, write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark.



United States Steel

EQUIPMENT



CARGO CAPSULES, built by Lockheed Aircraft, are loaded by Pan American World Airways Boeing 707-120 jet transport at Miami in preparation for its cargo service to San Juan, Puerto Rico. Aerial view. The system can load and off-load cargo in 20 min.

Airlines Evaluate Cargo Packs for Jets

By Barry Tull

New York — Jet-equipped airlines striving to speed ground handling time are re-evaluating government-issued cargo packs and improved container systems between aircraft and baggage collection points. The improvement of ground handling is key, particularly with night-flight speed increases, as posing a problem with the large-capacity jetliner aircraft. Most cargo solutions are carrying out studies designed to improve ground handling in general.

System Advantages

The use of cargo packs as units compatible with this system is growing.

Advantages of the system are that all baggage tagged for a particular destination is placed in one or more specially marked containers. The containers are then loaded in a logical order and unloaded with the passengers at corresponding stops. This eliminates sorting through baggage labels at each intermediate stop and reduces the possibility of lost baggage. Another ad-



CONTAINERS are held up to 1,500 lb each and are lifted into the plane's forward cargo compartment by conventional lifting equipment. Trucks are floor lock containers into plane

AVIATION WEEK, May 14, 1960



FAMOUS ARC COURSE DIRECTOR SYSTEM NOW EXPANDED TO RECEIVE ADF (LF) SIGNALS

The original ARC Course Director, tuned to any VOR or LOC station enabled the pilot to intercept any desired course and follow it accurately by keeping the cross-pointer needle centered.

Now, in areas where there are no local stations or localizers, navigation information, received by the ADF is computed automatically by the CD-4 and presented visually on the cross-pointer meter. Because the ADF function is now included in the Course Director system, you can fly with precision using the ARC Course Director principle on all low frequency facilities.



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Research, Design, Development and Production of Dependable Communications, Navigation and Related Electronic Equipment since 1925



Why jet trainers depend on Bendix Generators

Nothing is more important to the successful training of flying aviators than proper equipment. . . . equipment that delivers dependable, lightning performance. That's one of the reasons Bendix Red Bank Generators are so widely used on training aircraft of all types. Training aircraft rely on Bendix Red Bank Generators to provide the vital electric power for radio,

radio, navigation aids, instruments and other equipment.

The 300-40 generator shown is a 400 ampere DC machine. It will produce 300 amperes with 130° C. cooling air. It has a wide speed range (3,000-6,000 RPM), and weighs only 45 lbs. It is ideally suited for use on all types of trainers.

For more information about



Bendix Generators and their long record of successful service in all types of aircraft, write to SUCCESS AND BANK DIVISION, ANN ARBOR, MICHIGAN.

New York Office: 17 E. Broadway, Building Call Radio Sales and Service, Radio Instrument Division, 105 E. 42nd St., New York 17, N.Y. (Landon 4-6100). Montreal Office: 100 St. James St., Montreal, Quebec.



Bendix's F42 and North American's new T-28 are equipped with Bendix Red Bank Type 300-40 DC Generator. Many aircraft used in the air exhibit the Bendix trainers equipped with the Bendix generator.

Red Bank Division
ANN ARBOR, MICH.

Bendix
ELECTRICAL

wastage of the probe or protection from rain during the winter.

The cargo parks are even more useful in handling cargo than baggage, according to some airlines not equipping the baggage containers. In addition to providing protection from weather and moisture, the cargo containers may be loaded during off peak hours and not stored the aircraft by two or three crew, thus diverting the workload.

In some cases the parks are loaded by the airline and tracking service, and opened at the ultimate destination.

The cargo parks are designed to fit the cargo hatch of the particular aircraft. When loaded, they are secured on special tracks to the aircraft where they are placed aboard by means of electric hoists or fuel lifts.

Tracks provide the resistance to be placed forward or aft within the cargo hold.

The containers are then locked into position to prevent shifting in flight. The process is reversed to off-load any or all of the containers at a terminal.

Weight Penalty

Disadvantage of the cargo park system is that it contributes a weight penalty of about 1,000 lb. and a slight reduction of takeoff capacity. Collins which would pump the track and jet caused the weight difficulty. United and American, however, has loading equipment of the system report that their systems are far more reliable. Additionally, a lack of cabin flexibility, in some cases, has proved discouraging. Service is hindered in some instances as if two straps are to be released. Proponents of the system, however, say that this will not interfere to speed throughout the cargo service.

New airline terminals are providing passenger baggage handling with an added feature of separate and aerial baggage delivery serving both conventional systems. One notable improvement is the use of containers in the distribution of aerial baggage in a long container which eliminates the fastening under second baggage return points. While not all new terminals employ the system, greater emphasis on baggage handling in terminal design is providing a great improvement.

Among the major airlines reviewed by ANALYSIS WEEK regarding baggage handling were:

• **United Air Lines**, employing a container instead of its own design on its Douglas DC-3 transports. The glass fiber containers each holding 35 bags, are lowered into the belly of the transport by means of electric hoists. The airline says it is placed with the ap-

proach of the speed of operation and for the weight of 100 to 150 passenger baggage. Due to limited clearance on the Boeing 730 ordered by the airline, the system will not be installed on that aircraft. The Boeing aircraft is too low to the ground to permit clearance for the container between the side-lodging system could be developed for the Boeing; however at present the airline plans to hand load the aircraft.

• **Pan American**, hand loading baggage on its transoceanic flights, is presently evaluating a Lockheed-developed cargo park system on its Miami San Juan and New York Miami routes. The system, employing self-lubricating pistons, mounting platforms and tracks on the forward cargo hold, will load or unload 5,000 lb. of cargo in 10 min from a Boeing 707. The cargo is raised in so numerous containers of 1,500 lb. capacity. The cargo is automatically 700 lbs. of fitted with the necessary tracks, will hold seven cargo parks in the forward hold. Pan American says that the system has particular advantages on type long New York to San Juan which operated to Miami under a new flight schedule after a short stop. The one intermediate stop for reloading cargo makes the use of cargo parks particularly advantageous. Pan American says that it is studying the possible use of prepackaged cargo on its west Atlantic operation.

• **Eastern Air Lines**, handloading baggage on its Douglas DC-3 and Lockheed Electra flights. The airline feels that this is the most efficient loading method for its particular operation. At Eastern's Atlanta and Miami terminals, crew members are used to increase loading speed and reduce the number of personnel employed.

• **American Airlines**, using loaded baggage containers on its Boeing 707 flights. The airline had originally installed the system on its Lockheed Electra, however, with the shift of the Electra to short-haul operation and the emphasis on cargo on baggage, the contract system was discarded as the aircraft. The airline is faced with the operation of the containers in order to fit, possible due to increased speed of handling and baggage protection. American has used a cargo box on its cargo aircraft for some years with considerable success.

• **Trans World Airlines**, hand loading baggage on its jet flights. The airline reports that it is studying various loading methods under a program to improve jet ground-handling operations. TWA will begin installation of the Douglas Glider system for loading baggage containers in May. The system, developed for cargo handling, requires suspended air jacks to permit the sliding of heavy containers to a smooth surface (AW May 2, p. 148).

BASIC BUILDING BLOCKS FROM KEARFOTT



ELECTROHYDRAULIC SERVO VALVE

Kearfott's unique approach to electrohydraulic feedback amplification design has resulted in a high-performance miniature servo valve with just two moving parts. Ideally suited to remote, inherently self-lubricating applications, these auto-aligning, 2-stage, solenoid actuator valves provide high linearity response and proved reliability even with highly corrosive fluids and under conditions of extreme temperature.

TYPICAL CHARACTERISTICS

Output flow . . . 0.15 gpm.
 Pressure . . . 250 psi
 Frequency Response . . . 0 to 100 cps
 Supply pressure . . . 500 to 2000 psi
 Temperature (Inlet & Outlet) . . . 0 to 150° F
 Flow Rate Range . . . 3 to 10 gpm
 Weight . . . 1.15 ounces

Write for complete data.



KEARFOTT DIVISION
GENERAL PREDICIEN INC.
LITTLE ROCK, ARK.



PROPellant cartridge, plugged into the belly of a North American F-100 fighter, carries assembled engine starts at a level of a rack per bottom. The inlet struts are a compatible with conventional compressed air starts.

USAF Adopts Cartridge Starter to F-100

Propellant cartridge, fuel-jet starter, designed for the Republic F-105 test of altitude, are being fitted to T-100 and F-100 fighters.

The 44th Tactical Fighter Squadron, England AFB, La., is the first F-100 unit to receive the cartridge starters which permit engine start independent of external ground power. A final application of this unit will be to start the Pratt & Whitney J55 turbo jet engine of the North American F-100 and the Howard Hughes HH-3B helicopter.

The cartridge starter developed by the Air Research & Development Command, Wright-Patterson AFB, Ohio, is a dual purpose, and providing conventional compressed air starts as well as cartridge starts. This provides "separable" capabilities which, permitting compressed air starts, makes several operating conditions or when propellant cartridges are unavailable.

The starter consists of cartridge chamber, piston, spark plug, combustion chamber, and spark plug. The cartridge chamber is a hollow shell, reduction gear, engaging mechanism, and spark plug shaft. The turbine wheel has a double flange. One

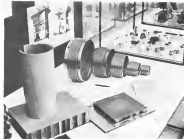
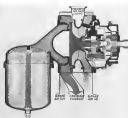
flange fits the conventional valve for operation with ground-supplied compressed air. On the back of the wheel are variable turbine buckets which produce equivalent power (150 hp) from propellant gas.

Cartridge chamber, and spark control other gas in air flow is means of separate valves and discharge passages. The gas flowing through spark plug and turbine bearings, gas valves and engaging mechanism.

The upper cartridge assembly is bolted to the steel assembly. The spark plug cartridge chamber, which holds an Avco type, MXU-4 cartridge, is fitted to the same cartridge chamber



TURBULET starter turbine produces approximately 150 hp from 4 lb. propellant cartridge or compressed air flow. Discharge (right) shows clockwise flow routes to turbine fuel turbine wheel, permitting cartridge or air starts.



East Germans Display Honeycomb Structures

Honeycomb structural shapes and a series of standard engine parts indicated size of the direction of component and engine research in the East German aviation industry. Displayed at the Leipzig Aviation Fair, the honeycomb samples showed some typical of conventional jet or compressor systems, welded metal or bonded with paper resin (impregnated) and a plastic resin and die sample (development). Expansion joints used in size from 3 in. diameter to 20 in., and in length from 3 to 6 in.

In series of a honeycomb fitting. The piston steel is bolted to the gas bearing assembly. Within the piston, a water bearing provides support for the pneumatic seals which divert cartridge exhaust gases and are discharged from the aerodynamic flow to an exhaust port.

Electrically Armed

The cartridge is electrically armed when the movable discharge chamber, containing a solid propellant charge, is inserted in the firing chamber by means of the bonnet fitting. This is accomplished by ground personnel with an air tool.

The cartridge is fired upon activation of a cockpit button. Gases generated by the burning propellant flow through the upper cartridge chamber and the hot gas nozzle, then are directed on the turbine wheel and exhausted through the upper cartridge chamber and the hot gas nozzle, then are directed on the turbine wheel and exhausted through a port in the piston. Turbine generated by the turbine is transmitted through the reduction gear system and engaging mechanism to the spark control shaft.

This shaft is coupled directly to the engine turbine.

When the engine starts, the spring-loaded pins of the engaging mechanism are disengaged by centrifugal force at 3,000 rpm. Starter occupied, at the

point of disengagement of the engine pins to cartridge assembly, is prevented by the locking action of nonreturn valves on the lower face of the starter turbine.

A safety ring in the upper discharge chamber is designed to rupture in the event of excessive compression. Additionally, the starter unit is designed to contain any structural failure preventing any damage to the engine.

Carried on starts with the starter are possible with any equipment which supplies air at 50 psi and 120°F.

Boeing Gas Turbine Will Power DSN-3

Boeing 302 turbojet engine will be installed at Navy's Graceland DSN-3 base and subsequent helicopter is to be used to operate at Fort Belvoir, Ariz. Helicopter operations. The small, ground-based helicopter will be armed with a burning anti-aircraft missile. The engine built by Boeing Industrial Products Division, will attain 270 hp by itself using at 5,500 rpm. Engine installation will be completed from the helicopter transmission Boeing develops it as a single-cycle, two-shaft turbine with a gas producer turbine wheel with variable inlet attached turbine blades of a new high temperature, high strength alloy.

BASIC BUILDING BLOCKS FROM KEARFOTT



FERRITES

Kearfott's Solid State Physics Laboratory formulates, fires and machines precision magnet ferrite materials of unique compositions. Typical high efficiency ferrite materials include: Kearfott PM-3 ferrite material with specially designed pole pieces in precision design built magnetic lighters than other types of magnets; magnetic field strength ferrite materials. Because magnets may be custom engineered to specific requirements, size is not restricted to stock magnet types, thereby providing greater freedom in precision field focusing strips. Pole pieces may also be provided according to special design, with the added assurance that, because of special Kearfott design techniques, all special magnetic fields are approximately 10% higher than those generally obtained in standard type magnets.

TYPICAL CHARACTERISTICS

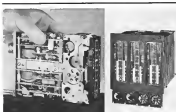
Temp. Range	100° to 200°
Flux Density	10,000 gauss
Resistivity	10 ¹⁰ ohm-cm
at 100°C	10 ¹⁰ ohm-cm
at 200°C	10 ¹⁰ ohm-cm
Weight	1.2 gm/cm ³

Write for complete data.



KEARFOTT DIVISION
GENERAL PRECISION INC.
LITTLE ROCK, ARK. 72604

NEW AVIATION PRODUCTS



Grumman A2F-1 Engine Instruments

Variable-volume indicators are used to display performance data of the Pratt & Whitney JT3 engine on the Grumman A2F-1 Navy attack aircraft (NAW Misc 9, p. 94). The instruments built to right provide exhaust gas temperature, percentage of rpm, and fuel flow information. Data beneath the variable-volume indicators provide preset limits and all engine readings. The zero-drive self-inducing instruments were developed for the A2F by the General Electric Co.

Life Vest Inflator

Water-activated life vest inflator preheats a standard carbon dioxide cartridge upon immersion in water. The inflator, employing a pyrotechnic element, will withstand or



resist to 350° heat without opening. Other applications include emergency life rafts and rescue rafts on motor.

All Cadence Division, The Garrett Corp., Bakers, N. J.

Jet Navigation Computer

Algebraic computer for solving wind and true airspeed problems is intended for jet transport pilots.



hold its shape for application of heat, then providing the required insulation. The white insulating material has been exposed to temperatures to 4,000° if necessary, cables can be treated with Dyna-Therm 55 after exposure to heat. Solty, agent for the product will be available, Inc., Los Angeles.

Dow-Derm Chemical Corp., Dallas City, Calif.

Portable X-Ray Tester

Portable X-ray metal powder radio graphic, non-destructive inspection of aircraft structural members coated surfaces and welds.

The X-ray machine is used during periodic aircraft checks and following hard landings and generally scheduled flight. X-ray plates provide a permanent record and can withstand growth of known fatigue cracks by comparing plates exposed over weeks of progressive intervals.

Johnson Electric Corp., Stamford, Conn.

Rope Winch

Rope winch for loading and unloading cargo aircraft weighs 57 lb and consists of a double pulley of 1,500 lb. The winch can move skid packages of 2½



tons or inflating loads of 7½ tons on a single line.

Model 51 rope winch has a hauling speed variable from 0 to 36 fpm and exerts a pulling force on a drum similar to the amount of tension applied by the operator. The winch is available with 2½ x 6 or 400 cps or motor. The winch is equipped with anchor hook, be driven and reverse cables to meet movement.

Air Corp. Equipment Co., 1125 E. Colorado St., Glendale 5, Calif.

Component Handling Trailer

Component trailer is designed to handle sensitive systems and components weighing up to 3,000 lbs.

The tool supports trailer provides free travel control of load position as pitch,



roll and elevation variable capabilities and includes 10 deg wheel position tilt.

Northrop Corp., North Division, 1000 E. Broadway, Hawthorne, Calif.

Radio Antenna Rod



Multi-operated rod is designed for taking more radio stations via single wire antenna. The rod is said to be designed for an antenna which enables frequency to be transmitted with 91% of power retained of the conventional rod.



Burner Simulates Aerodynamic Heating

The 10 million Btu/hr. pulse burner heater, part of a unit to simulate heating effects encountered in aircraft and missiles, was developed for Douglas Aircraft's Aerophysics Laboratory in the Convulsion Engine, Woodville, Calif. Burner built as its designers have ranging from 300° to 3,100°. Complete unit will be mounted to Aerophysics' 2½ in. wind tunnel at the El Segundo Division.

The weighted antenna extends 178 ft from the rail to a hubbed air jet point by means of a buckle which has a 500 in. B. holding force. A cockpit cable for register the length of the cable. Cable consists of 1½ ft open sections of the 11½ x three plane 400 cps ac cables capable of a 90 lb pull. The gun test buckle and timer are enclosed in the net which measures 406 in. in diameter, 54 in. in length and weighs 65 lb. An explosion-protected clear glass permits viewing an extended cable.

General Controls Aircraft/Electronics Division, 1300 S. Flower St., Burbank, Calif.

WHAT'S NEW

Publications Received

Advances in Astronautical Sciences Vol. 4—Pittman Press, Inc., 217 West 17th St., New York 11, N. Y. 55,000. Focus upon presented at the Fifth Annual Meeting of the American Astronautical Society, held December, 1970, the scientific and technological progress of astronautics and aerospace technology research from both theoretical and experimental aspects.

Space Flight—Vol. 4—Environment and Geologic Materials—Kraft A. Ehrhard-D. Van Nostrand Company, Inc., Princeton, N. J. 514,750. This volume covers concept of space flight and the environment in which it will take place.

BASIC BUILDING BLOCKS FROM NEARPOTT



INTEGRATING TACHOMETERS

Kearfott Integrating tachometers, special types of rate converters, are shock-tolerantly provided one specially equipped for flight use. They feature tachometer generators of high output-to-rpm ratio and are temperature-stabilized or compensated for flight use. Accuracy of these converters, lightweight tachometers ranges as low as .02% and is generally better than .01%.

TYPICAL CHARACTERISTICS

Size	11
Weight	6000
Derivative Voltage	500 cps / 115
Rate at 0 rpm	0.000 — 0.25
Rate at 1000 rpm	0.000 — 0.25
Phase shift at 3600 rpm	— 0.25
Linearity at 0-3600 rpm	— 0.1
Operating Temperature Range	— 64° — 125°

*Write for complete data.



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To the extent that it is known at the time, the flight data is placed on the world map, performance tables are constructed, data used in the graphs and illustrations is as well as local coloration and short-cut north-south grain in the orbital mechanics chapter.

First Into Outer Space—Theodore J. Gordon & Julian Scheer—St. Martin's Press, 175 Fifth Ave., New York 10 N. Y. \$3.95. An account from inside a MiG-15 of a U. S. jet's entry into outer space.

The Seven Miles—John Palfrey—Penguin, 41 Great Russell Street, London.

Approximately 54,000 (30 shillings) A report and analysis of British Overseas Airways Corp., the governing body in India and Australia, down the African continent and the various subcontinent. The author had the collaboration of the management and staff of the airline to aid and suggest the account.

Aircraft and Missile Design and Maintenance Handbook—Dr. Charles A. Grier—The Macmillan Co., 66 Fifth Ave., New York 11 N. Y. \$9.75, 500 pp. Illustrations and explanations of equipment installation and maintenance. Electrical and plumbing sec-

tion, material of construction, aircraft and missile hardware, color codes and conversion tables and various procedures on wiring topics covered.

Air Traffic Control—C. D. Colchester—Merrill's Wireless Telegraph Co., Ltd., Marconi House, Chiswick, Essex, England. Approx. \$2.46, 100 pp. A report compiled from such sources as the Ministry of Transport and Civil Aviation, the Air Traffic Control Experimental Unit at London Airport and General Precision Laboratories, dealing with traffic control development and its present state.

Nondestructive Testing—Pennington-Tenth National Symposium on Nondestructive Testing of Aircraft and Missile Components. San Antonio, Tex. 1960. An outline of some testing problems and how they were solved in the aircraft industry.

Fire Control—Franklin-Walker Wright and John Brooks. McGraw-Hill Book Co., Inc., 116 W. 43rd St., N. Y. 36, N. Y. \$10.00, 335 pp. Book documents the latest aircraft and guidance applicable to air air control problems. Methods of solution and the various tactical techniques applicable to all fire control systems are discussed.

Practical Bombers of the Second World War—William Green—Doubleday Books, 175 Madison Ave., N. Y. \$3.95. Stories of the bombers employed by Britain, the U. S., Germany and Italy along with drawings showing full operational settings.

Man's Race—John P. Rider, Publisher, Inc., 116 W. 14th Street, New York, N. Y. \$1.95, paperback, 30 pp. Based on the technical and psychological factors of the U. S. race of human beings to be sent to the moon.

U. S. Marine Corps Aircraft 1914-1959—William T. Lorlean—Aviation History Publications, Post Office Box 626, Concord, Calif. \$5.00. A pictorial history of USMC aircraft (176 photographs).

Twenty Seconds to Live—Elizabeth Lind—E. P. Dutton & Co., Inc., 300 Fourth Ave., New York 10, N. Y. Story of USAF captain Lt. James Olsen who landed a stricken Boeing B-47 safely, saving an experienced crew member.

The Rocket Handbook for Amateurs—Lt. Col. Charles M. Paffen, Jr.—The John Day Co., New York, \$5.95. This handbook was prepared to show amateurs the type of basic knowledge essential in the safe construction, testing and launching of rockets.



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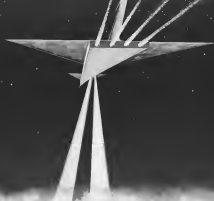
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RYAN ELECTRONICS

WHO'S WHO

(Continued from page 17)

Honors and Elections

Dr. Hans K. Betschinger has been elected to the Graduate Faculty Executive at the Georgia Institute of Technology for 1958. His lecture will be held at the Leverage High School Symposium, Longwood, Mass. June 1, 1957, 7 P.M.

Ronald B. Dornick has received the Alan Watts Chemical Co's 1956 Award for his leadership in the development of the Federal Aviation Act of 1958.

James C. Follen of Bell Telephone Corp. has been named "Scientist of the Year" in a special public relations issue by the Western Union Co. Mr. Follen was cited for work in encouraging establishment of colleges and his activities in behalf of students generally.

Frederick D. Brodsky chief engineer at the Ames Research of Ames, California Co. has received the Flight A. Wright Award for 1958 for outstanding contributions to the field of aerodynamics.

J. W. Keating, manager of Ampex Corp. has been named "Pilot of Progress" by the Federal Aviation Administration. Mr. Keating has been selected for an "Aero Pilot" Star Fellowship for a year of emergency study at Massachusetts Institute of Technology.

Changes

Hil M. Thomas, program manager and **Tom J. Gordon**, project engineer for the

Batesa sound stage program, Douglas Aircraft Co. Inc., North Haven, Conn.

Leon J. Linn, vice president of the company, has been named the following appointments: **Arnold B. Mittle**, director of Longwood; **Robert J. Robinson**, chief assistant to the director of Longwood; **Walter E. Ruffalo**, director of Longwood; **Harold T. Justice**, program manager for general advisory services in the National Aeronautics and Space Administration; **Robert M. Mittle**, and **Spencer D. Brown**, Longwood, Conn.

Martin C. Shuman, manager of engineering, Control Systems Co.'s Small Aircraft Engine Department, Longwood, Mass.

William J. Buchanan, director of research and engineering, MSCUP Division of Fairchild-Victor Research, Inc., Princeton, N. J.

Dr. Stephen J. Angillo, manager of aircraft instrumentation program, Westinghouse Electric Corp.'s Air Force Division, Baltimore, Md.

Michael A. Monahan, chief engineer, Ford Instrument Co., a Division of Sperry Rand Corp., Long Island City, N. Y.

Rose Eberhart, Division of Ryan Instruments Co., San Diego, Calif., has announced the following appointments: **S. W. Holbeck**, chief assistant engineer; **Norman V. Gossard**, chief of operations and test; **W. J. Hammer**, chief of budgets.

Dr. Joseph W. Carter, director of the Physical Science Division of Space Systems Laboratories, Bethesda, Md.

Dr. Max G. Stanley, assistant director of research, General Transducer Corp., Ithaca, N. Y.

Leonard D. Sullivan, manager of Raytheon Co.'s Washington, D. C. office.

Dr. David Van Meter, manager and **John W. Gaudin**, assistant manager, Applied Science Division of Northrup Inc., Hawthorne, Mass. a subsidiary of Washington, Va. Radio Co.

Dr. Elmer S. Shuman, head of nuclear research group, Hughes Aircraft Co.'s Nuclear Electronics Laboratory, Los Angeles, Calif.

Dr. Herbert, manager of radio, Marine Services Division of Republic Aviation Corp., Farmingdale, N. Y.

Herbert A. Cohen, manager, Dept. of Research Division of Ryan Laboratories for Jeton, Mass. a subsidiary of Technology International Corp.

Ray D. Gardner, chief engineer, Harlan, Voss, Inc., Fairfax, Calif., a subsidiary of Houston, Texas Corp. according to **John N. West** who continues as vice president of engineering.

George W. Freeman, general manager of Thompson, Stone, Woodbridge, newly established Instrument Division, Oswego Park, Calif.

Samuel G. Goss, vice president of Ryan Instruments Co., San Diego, Calif., has appointed **Dr. Thomas J. O'Connell** manager of the W-100 Acoustic Propulsion Program production of water for the Mark 1000 with hydroplanes at Fair, Fresno, Calif.

E. Floyd Sherman, director of program development, Systems Laboratory, Division of Electronic Systems Co., Los Angeles, Calif.

Robert M. Bellows, manager, Dept. of Systems, Hughes Aircraft Co., Culver City, Calif.



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EMPLOYMENT OPPORTUNITIES

EMPLOYMENT OPPORTUNITIES
The advertisement in this section is for all men and women who are interested in the following categories unless otherwise stated: **Professional**, **Executive**, **Administrative**, **Engineering**, **Production**, **Technical**, **Research**, **Development**, **Manufacturing**, **Marketing**, **Sales**, **Service**, **Construction**, **Transportation**, **Health**, **Education**, **Public Administration**.

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To apply professional experience as an electronic engineer, contact us and send your application in confidence to: W. A. DeWitt, Personnel, Honeywell, 1471 Shaker Road, Minneapolis 12, Minn.

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Seeking Position: System to design and develop for inertial systems. Experience in design and development of inertial systems. Seeking position in design and development of inertial systems. Seeking position in design and development of inertial systems.

Seeking Position: System to design and develop for inertial systems. Experience in design and development of inertial systems. Seeking position in design and development of inertial systems. Seeking position in design and development of inertial systems.

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SEMI-CONDUCTORS

IBM scientists and engineers are working on both semiconductor components as well as on applications for these components. For example, applications of the Zulu diode are being investigated in Development, while Research is probing deeper into the fundamental physics of this new component.

HUMAN FACTORS ENGINEERING

This field is playing an increasingly important role in systems development at IBM. When a system is first envisioned, the human factors engineer is asked to determine the possible extent and nature of human participation. He predicts the task requirements of the operators and reviews operating and maintenance procedures to ascertain if they are reasonable and achievable by human beings.

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Mr. E. L. Jeno, Dept. 52403, IBM Corporation, Box 300, Poughkeepsie, New York

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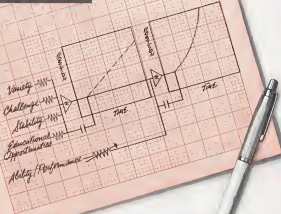
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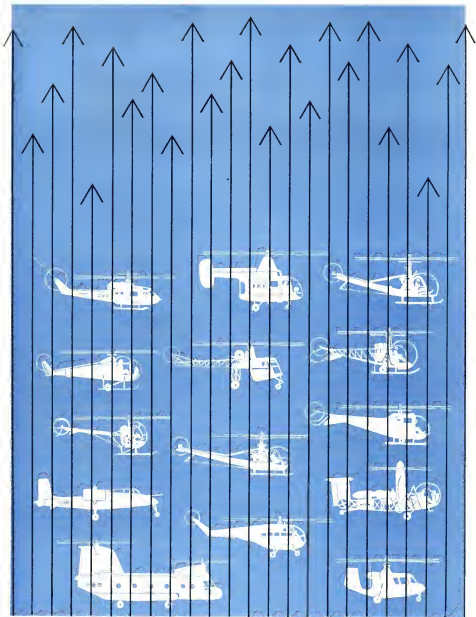
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